

AD-A167 428

The Enlistment Bonus Experiment

J. Michael Pollich, James N. Dertouzos,
S. James Press

DTIC FILE COPY

DTIC
SELECTE
MAY 5 1986
S A D

This document has been approved
for publication and sale; its
distribution is unlimited.

Rand

86 5 5 03 9

The research described in this report was sponsored by the Office of the Assistant Secretary of Defense/Force Management and Personnel under Contract No. MDA903-85-C-0030.

ISBN: 0-8330-0724-6

The Rand Publication Series: The Report is the principal publication documenting and transmitting Rand's major research findings and final research results. The Rand Note reports other outputs of sponsored research for general distribution. Publications of The Rand Corporation do not necessarily reflect the opinions or policies of the sponsors of Rand research.

Published by The Rand Corporation

R-3353-FMP

The Enlistment Bonus Experiment

J. Michael Polich, James N. Dertouzos,
S. James Press

April 1986

Prepared for the
Office of the Assistant Secretary of Defense/
Force Management and Personnel



APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

PREFACE

This is the final report on the results of the Enlistment Bonus Experiment, a national test conducted by the Department of Defense and the U.S. Army. The experiment originated when Congress passed the Uniformed Services Pay Act of 1981, which permitted the military services to pay larger cash bonuses to certain enlistees. At that time the House/Senate Conference Report directed the Secretary of Defense to initiate a test of the newly authorized bonuses in order to evaluate their effects on recruiting. The Rand Corporation's Defense Manpower Research Center assisted in the test design and was responsible for analysis of the results, on behalf of the Assistant Secretary of Defense for Force Management and Personnel.



Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
1st	Special
A-1	

SUMMARY

The Department of Defense recruits and trains approximately 300,000 new enlistees for military service annually. One of the principal challenges for defense managers is attracting a sufficient number of these recruits into critical occupational specialties, within a reasonable level of recruiting expenditures. This report describes the results of a nationwide experiment directed by Congress to test a key recruiting incentive: the cash enlistment bonus.

DESIGN OF THE EXPERIMENT

The purpose of the Enlistment Bonus Experiment was to assess the effects of expanded cash bonuses authorized by Congress to attract highly qualified young people into military service. Two new bonus programs were tested in the Army: an increased bonus for a four-year enlistment, raised from \$5000 to \$8000; and (2) a new \$4000 bonus for a three-year enlistment. The new bonuses were restricted to high school graduates with qualifying test scores who enlisted in Army skills that previously paid the \$5000 bonus.

The basic design of the test called for three cells with the following bonus offerings:

- *Cell A* (70 percent of the nation): \$5000 bonus for a four-year enlistment (the control program)
- *Cell B* (15 percent of the nation): \$8000 bonus for a four-year enlistment
- *Cell C* (15 percent of the nation): \$8000 bonus for a four-year enlistment, or \$4000 bonus for a three-year enlistment

Each cell was composed of local areas that were assigned to the cells by a randomized process, with constraints ensuring that the cells were well balanced. Balancing variables included factors such as previous enlistment rates, civilian economic conditions, measures of geographic location and dispersion, and Army recruiting goals. Each cell thus made up a representative sample of the nation.

The test was run from July 1982 through June 1984. To monitor the results, Rand collected monthly data during the test period and a one-year base period. These data included enlistment rates and factors that could influence the test outcomes, such as economic conditions, recruiting resources, and advertising delivery.

ANALYSIS PROCEDURE

Bonuses have three possible effects on different stages of the enlistment process:

- *Market expansion effects:* Increases in the total number of people joining the Army
- *Skill channeling effects:* Shifts in enlistments toward skills eligible for the test bonuses
- *Term of enlistment shifts:* Changes in enlistees' choices among four-year, three-year, and two-year terms of obligated service.

The analysis procedure was designed to quantify each of these effects. It uses a multivariate, simultaneous equations model that, in effect, compares year-to-year changes in monthly enlistment totals between the test and control cells, adjusting for changes in extraneous factors that could affect the results. This method controls for many types of influences, such as cross-cell differences in demographic characteristics or changes over time in national attitudes toward military service.

In addition, the model considers effects of recruiter responses to the bonus changes. For example, if the new bonuses increase the number of volunteers and goals remain unchanged, recruiters could reduce their effort and still attain their goals, thus masking the bonus effect. The model also considers "high-quality" and "low-quality" enlistments separately, explicitly incorporating the tradeoff that recruiters face between activities that tap the high- and low-quality markets.¹ By representing these phenomena through a series of underlying structural equations, the model makes it possible to estimate directly the effect of the bonuses on high-quality enlistments, holding constant all other factors.

RESULTS

The analysis of market expansion effects showed that the B Cell program (an \$8000 bonus for four years) had the potential to produce 4.1 percent more high-quality Army enlistments than did the control program. That result is statistically significant at the .10 level. In the case of the C Cell program (\$8000 for four years, or \$4000 for three years), the corresponding increase was 5.0 percent, significant at the .05 level. These estimated effects are based on the analytic model holding constant all other factors, including economic and recruiting resource factors and recruiters' level and direction of effort.

¹A high-quality enlistee, as defined by the Army, is one who has a high school diploma and an aptitude test score in the upper half of the youth population.

The analysis revealed much larger bonus effects on enlistees' skill and term of enlistment choices. We studied these effects by adding extra equations to the market expansion model to show (1) the impact of the test programs on enlistments in test-eligible skills, controlling for the total number of Army enlistments and (2) the impact of the programs on the distribution of enlistments among two-, three-, and four-year terms, controlling for the number of enlistments into those skills. The resulting estimates are as follows:

B Cell. Compared with the A Cell, the B Cell program produced 31.7 percent more high-quality enlistments in eligible skills, even after controlling for the market expansion effect. The program also shifted enlistees' choices of terms, increasing their rate of four-year commitments by 15.3 percent while reducing three-year and two-year commitments.

C Cell. The C Cell program produced 41.5 percent more high-quality enlistments in eligible skills than did the A Cell program, net of other effects. It also increased the rate of three-year enlistments by 87.4 percent, while maintaining essentially the same rate of four-year commitments as in the A Cell and reducing two-year commitments.

The market expansion results are magnified when viewed in conjunction with the bonuses' simultaneous effects on term of service choices. The expanded bonuses both attracted more recruits and lengthened their average term of commitment. Compared with the A Cell, the test programs increased the total number of man-years obligated to the Army by 6 percent in the B Cell and 8 percent in the C Cell.

Thus, the experimental results show that bonuses can have substantial effects on recruiting. In addition, bonuses are a very flexible policy tool, by design. Without altering the fundamental structure or level of military compensation, bonuses can be quickly altered when shortages appear in specific personnel categories. This flexibility, combined with the large effects of bonuses on skill and term of service choices, indicates that bonuses are a useful option for management of enlistment flows and for overcoming personnel shortages in critical skills.

ACKNOWLEDGMENTS

This study was made possible by the continuing interest of the Directorate of Accession Policy, Office of the Assistant Secretary of Defense for Force Management and Personnel. Particular thanks are due to G. Thomas Sicilia and W. S. Sellman, consecutive Directors of the Accession Policy office, and to Ron Liveris, project officer for the study, for their support in ensuring a rigorous design and careful execution of the experiment.

We are also indebted to the U.S. Army Recruiting Command, successively commanded by Major Generals Howard G. Crowell, Jack O. Bradshaw, and Allen K. Ono, for close cooperation in implementing the experiment and monitoring its outcomes. In particular, we received valuable advice and voluminous amounts of data on the Army recruiting system from Colonel Richard Cato, Lieutenant Colonel George Thompson, Major Michael Brandon, and Captain Wilt Ham of the Recruiting Command's Directorate of Program Analysis and Evaluation. The Directorate of Advertising and Sales Promotion, under Colonel Donald Borden and Colonel William Graf, also cooperated in supplying us with detailed data on the Army's national and local advertising programs.

Les Willis and Paul Nickens of the Defense Manpower Data Center provided us critical enlistment data and shared useful advice based on their experience with Department of Defense data systems. We also relied heavily on the expertise of Rand programmers Jeff Garfinkle, David Swan, Judith Moses, and Janice Hartman, and on a dedicated data management staff supervised by Lois Haigazian and Lisa Stewart. Typing and report preparation were handled expertly by Marilyn Yokota. For helpful technical reviews and comments on earlier drafts we are indebted to Paul Hogan, Director of Manpower Planning and Analysis, Office of the Assistant Secretary of Defense for Force Management and Personnel; and to Marygail Brauner, Glenn Gotz, James Hosek, and James Kahan of Rand.

CONTENTS

PREFACE	iii
SUMMARY	v
ACKNOWLEDGMENTS	ix
FIGURES AND TABLES	xiii
Section	
I. INTRODUCTION	1
II. BACKGROUND OF THE EXPERIMENT	3
The Underlying Concern: Recruit Quality	3
Bonuses, Enlistment Incentives, and	
Recruiting Resources	5
Origin of the Bonus Experiment	7
Potential Effects of the Bonus on the	
Enlistment Process	9
III. DESIGN OF THE EXPERIMENT	12
Programs Tested	12
Test Cells	13
Assigning Areas to Test Cells	14
Execution of the Test	17
IV. ANALYZING THE ENLISTMENT PROCESS	20
Stages in the Analysis	20
Basic Analysis Strategy	21
Adjusting for Changes in Covariates	24
Covariate Definitions	25
Controlling for Recruiter Behavior	27
V. RESULTS	36
Market Expansion Effects	36
Bonus Effects on Skill and Term of	
Service Choices	42
Total Effects	46
Man-Year Projections	47
VI. CONCLUSIONS	49

Appendix

A. SUPPLEMENTARY TABLES	51
B. A NOTE ON COSTS	53
C. DEFINITIONS OF SKILL CHANNELING AND MARKET EXPANSION	56
BIBLIOGRAPHY	59

FIGURES

1. Areas in the Enlistment Bonus Test	18
2. Stages in the Analysis	20
3. Potential Effects of Recruiter Choices on Bonus Results . . .	29

TABLES

1. Quality of Army Enlistments, 1980-1984 (Nonprior Service Males)	4
2. Army Bonus Program Before the Experiment	6
3. Army Enlistment Contracts During Base Year, By Term of Service, Quality Level, and Skill Group	7
4. Test Cells	13
5. Test Cell Balancing	15
6. Illustrative Comparison of Enlistments in Test Cells	22
7. Covariate Values During Base and Test Periods	25
8. Key Features of the Contract Model	31
9. Individual Recruiters and Battalion Performance: 1983 . . .	33
10. Coefficients: Model of High-Quality Enlistment Contracts	37
11. Coefficients: Models of Contracts By Skill Group and Term of Service	44
12. Net and Composite Effects of Bonus Programs	45
13. Projected Man-Year Changes for Bonus Programs	47
A.1. Bonus Test Balancing Variables	51
A.2. Test-Eligible Occupational Specialties	52
A.3. Means and Standard Deviations of Analysis Variables . . .	52
C.1. Hypothetical Data Illustrating Market Expansion and Skill Channeling Effects	57

I. INTRODUCTION

The Department of Defense annually recruits and trains approximately 300,000 new enlistees for military service. Since the end of the draft in 1972, all of these personnel have been volunteers who chose the military over alternative possibilities such as civilian employment or education. One of the principal challenges for defense managers in recent years has been to attract these volunteers within a reasonable level of recruiting expenditure.

Both Congress and executive branch agencies pay close attention to expenditures for recruiting. Defense manpower policy issues often center on questions of recruiting incentives and resources. How much compensation, what types of benefits, and what levels of recruiting support are needed to obtain the required quantities and mix of enlistments? These questions have been particularly acute for the Army, which has historically experienced more difficulty than the Navy, Marine Corps, or Air Force in recruiting the capable personnel needed to handle increasingly sophisticated equipment. In the past, however, decision-making has been handicapped by a lack of precise and reliable information about the behavioral responses of young people to various recruiting policies.

This report describes the results of a nationwide experiment designed to provide new data on a key enlistment incentive: the cash enlistment bonus. The bonus, paid to qualified recruits entering critical occupational specialties, has become a major feature of military recruiting packages, particularly in the Army. Responding to a mandate from Congress, the Department of Defense and the Army undertook a two-year test, from July 1982 through June 1984, to determine the costs and enlistment effects of expanded bonuses for various terms of active duty service. The Rand Corporation assisted by designing the experiment and analyzing the data.

Three principal questions were addressed:

1. Would increased bonuses attract significantly more "high-quality" recruits into the Army?
2. Would larger bonuses encourage more enlistments in the hard-to-fill critical specialties?
3. Would an expanded bonus program influence recruits to sign contracts for longer terms of service?

The purpose of this report is to document the experiment, explain our analysis, and assess the effects of enlistment bonuses on the Army recruiting process. To understand the experiment, it is essential to appreciate the objectives of the recruiting system, the role played by enlistment incentives in the process, and the circumstances under which the bonus experiment originated. The next section reviews that information. Successive sections describe the experimental design, data and analytic approach, empirical results, and conclusions.

II. BACKGROUND OF THE EXPERIMENT

THE UNDERLYING CONCERN: RECRUIT QUALITY

Success or failure in recruiting depends, in large part, on the personal characteristics of new recruits. The services do not face an outright shortage of people; in recent years, at least, they have always been able to meet their volume requirements. The problem has been attracting the right *kind* of people—namely, those regarded as “high quality” recruits. Our analysis and our observations of recruiting activities in the field make it clear that there is a large supply of less qualified people willing to enlist; more capable individuals, however, are less likely to volunteer and hence are more costly to obtain.

The services regard educational attainment and aptitude as the two primary indicators of quality in an enlistee. Following nomenclature generally used by the Department of Defense and the Army, we define a high-quality recruit as one who:

- Is a high school diploma graduate and
- Has received a percentile score of 50 or higher on the Armed Forces Qualification Test (AFQT)

Experience has shown that recruits who are high school graduates are considerably more likely than dropouts to remain in the service for their full term of commitment, to conform to military standards of behavior, and to avoid disciplinary infractions.¹ Persons with high AFQT scores are more likely to do well in training, and by inference, are thought to have a higher probability of successful performance on the job.² For these reasons, the primary enlistment incentive programs—bonuses and the more generous types of educational benefits—are restricted to high-quality individuals.

All of the services, and especially the Army, experienced difficulty enlisting high-quality males during the late 1970s and early 1980s.³

¹Throughout this report, references to “high school graduates” include both those who have diplomas and those who are high school seniors at the time of signing an enlistment contract. Virtually all seniors who sign contracts obtain a diploma before entering active duty. For a review of the evidence indicating the superior record of such recruits, see Buddin (1984).

²For a review of the data showing the relationship between AFQT score and training success, see Office of the Assistant Secretary of Defense for Manpower, Installations, and Logistics (1985).

³The services do not perceive significant problems in recruiting females. Since the beginning of the all-volunteer force, female recruiting quotas have been readily reached, and the services have found it possible to accept only high-quality women. This reflects

Table 1 shows the quality level of Army recruits during the period when the Enlistment Bonus Experiment was being considered. At that time, the services were just emerging from a prolonged recruiting slump. In Fiscal Year 1980 the Army managed to obtain only about 33,000 high-quality enlistments, 22 percent of the total. This placed the aptitude of the average Army recruit significantly below the civilian norm, whereas recruits in the other services were above the norm (Office of the Assistant Secretary of Defense for Manpower, Installations, and Logistics, 1982). Although the situation has improved considerably in the last few years, the Army remains concerned about the quality of future cohorts of recruits.⁴ Approximately 50 percent of all Army enlistments have been in low-quality categories since 1983.

The disappointing results in 1980 prompted deep concern in the Department of Defense and Congress, leading to proposals to increase educational benefits and cash bonuses for enlistment. The principal source of this concern was apprehension over the viability of the all-volunteer force. In addition, there were long-term fears that the Army's increasing inventory of technologically sophisticated weaponry could drive up quality requirements in the late 1980s and early 1990s,

Table 1

QUALITY OF ARMY ENLISTMENTS, 1980-1984
(Nonprior Service Males)

Fiscal Year	High-Quality Enlistments	Low-Quality Enlistments	Percent High Quality	Total Number
1980	33,148	115,807	22	148,953
1981	34,199	73,211	32	107,410
1982	53,754	83,822	46	117,376
1983	66,949	85,228	51	132,177
1984	58,089	58,902	49	114,991

to some degree the low level of demand for females in the services' personnel policies. Many Army occupational specialties are closed to women because the job entails exposure to combat. None of the Army specialties that were included in the bonus experiment accept females, so this report does not consider female recruiting.

⁴The Army contends that its needs for high-quality personnel will continue to rise, although a precise method for determining the optimal level of "requirements" has not been established (see Office of the Assistant Secretary of Defense for Manpower, Installations, and Logistics, 1985).

at the same time that the size of the youth cohorts would decline.⁵ Thus, the stage was set for intense efforts to improve military recruiting, and for efforts to understand the effects of changes in recruiting resources.

BONUSES, ENLISTMENT INCENTIVES, AND RECRUITING RESOURCES

Compensation is one of the primary policy tools that managers possess to affect recruiting. However, in the military the compensation package is very complex and difficult to adjust, consisting of basic pay, allowances for food and housing, health care, retirement, and other "fringe benefits" that are closely regulated by law and changed only by Congressional action. Cash bonuses represent one area where the Department of Defense and the military services have fairly wide latitude in adjusting compensation. Basically, each service can, with Department of Defense approval, offer bonus payments up to a legislated maximum provided the bonus recipients enter occupational specialties designated as "critical skills." Under these circumstances an increase in enlistment bonuses becomes a potentially attractive mechanism for alleviating personnel shortages. Bonuses are flexible, since they can be added or deleted at any time without affecting elements of the future or current compensation package. In addition, they theoretically cost less than general pay increases, since they are paid only to persons in specialties with shortages. These advantages were among those cited by the Department of Defense in 1982 when it defended enlistment bonuses as a lower-cost alternative to new educational benefit programs that Congress was considering (Korb, 1982).

Table 2 exhibits the principal features of the Army enlistment bonus program before the experiment. Like other enlistment incentives, bonuses were restricted to high school graduates with qualifying test scores.⁶ In addition, bonuses were paid only to recruits who signed a contract to train and serve in one of a designated set of shortage skills. Under legislation then in effect, the maximum allowable bonus was \$5000, payable to a recruit after finishing occupational training in a qualifying critical skill. The Army offered the \$5000 bonus only for a few skills, primarily the traditional combat-arms specialties (infantry, armor, and artillery). These skills, historically among the most

⁵See Tan and Ward (1984) for a description of the youth cohort decline and an analysis of its effects on civilian wage opportunities.

⁶Until early 1981, the minimum qualifying AFQT score for Army bonuses was 30, but the minimum was raised to 50 thereafter.

Table 2
ARMY BONUS PROGRAM BEFORE THE EXPERIMENT

Bonus Qualifi- cations Required ^a	Skill Group (Occupational Specialty Category)	Enlistment Bonus Amount (\$), By Term of Enlistment		
		Four Years	Three Years	Two Years
HS Grad, High AFQT	Test-eligible skills	5000	0	0
HS Grad, High AFQT	Other bonus skills	1500- 3500	0	0
—	Nonbonus skills	0	0	0

^aBonuses are paid only to recruits classified as "high quality" (high school diploma graduates with AFQT scores of 50 or higher). Other recruits are ineligible for bonuses.

difficult to fill, were those selected for the bonus test; thus they are identified as "test-eligible" skills in Table 2. Many other skills, however, offered smaller bonuses, ranging from \$1500 to \$3500.

One of the Army's principal objectives for the bonus program was *skill distribution*, that is, encouragement for recruits to sign contracts for certain occupational specialties rather than others. In addition, the program was designed to encourage longer terms of service. As Table 2 shows, in each skill category, a qualifying recruit could choose to commit for a term of obligated service of two, three, or four years. However, by law bonuses could be paid only to those who signed four-year contracts.

Table 3 shows that bonus skills, in fact, did receive considerably longer terms of commitment. During the base year before the experiment, more than 75 percent of recruits entering the \$5000 bonus skills signed contracts for four years, compared with a figure of only 30 percent among recruits entering nonbonus skills.⁷ The data also indicate how extensive the combat-arms bonus program had become. The \$5000 bonus skills accounted for more than 13,000 enlistments during that year, representing 30 percent of all high-quality recruits. The resulting bonus payments (to those who signed four-year contracts)

⁷The term "base year" refers to the 12-month period (July 1961 through June 1962) immediately preceding the experiment.

Table 3

**ARMY ENLISTMENT CONTRACTS DURING BASE YEAR, BY TERM
OF SERVICE, QUALITY LEVEL, AND SKILL GROUP**

Quality Level ^a	Skill Group	Percent Distribution of Enlistment Contracts, by Term of Service			Total Number of Contracts
		Four Years	Three Years	Two Years	
High	Test-eligible skills	75.8	9.7	14.4	13,667
	Other bonus skills	58.3	24.2	17.4	7,828
	Nonbonus skills	30.6	53.5	15.9	24,997
Low	Test-eligible skills	34.9	65.1	0.0	19,217
	Other bonus skills	28.2	71.6	0.2	8,067
	Nonbonus skills	29.1	70.8	0.1	34,826

^aHigh quality - High school graduates with AFQT scores of 50 or more.
The base year is the 12-month period from July 1981 through June 1982.

totalled more than \$50 million, or about 80 percent of the Army enlistment bonus budget.

ORIGIN OF THE BONUS EXPERIMENT

Bonuses, of course, are not the only mechanisms used to influence recruiting. Prominent among the alternatives are educational benefits, which have been the subject of great public and Congressional interest over the past 10 years. These benefits commit the service to paying a specified amount for tuition, living expenses, and related costs of civilian postsecondary education for the recipient, after he completes a term of active duty. Educational benefits and bonuses are frequently

viewed as alternative programs that might ameliorate a difficult recruiting situation.⁸

In response to the wide support for larger educational benefit programs in 1980, Congress directed the Department of Defense to test a number of alternative educational benefit plans. The result was an experiment called the Educational Assistance Test Program, in which three new educational plans were offered to high-quality recruits in selected areas of the nation during Fiscal 1981. Rand designed and analyzed that test, and found, among other things, that expanded educational benefits for Army recruits in critical skills increased Army high-quality enlistments by 9 percent without harming the recruiting of the other services.⁹ Subsequently, that program, called the Army College Fund, was adopted nationwide in Fiscal 1982.¹⁰

The Army College Fund applied to all of the combat skills included in the \$5000 bonus program. Nevertheless, the Department of Defense, concerned all along that even with the increased educational benefits, enlistments might not meet projected requirements, pressed for further expansion of the bonus program. Therefore, in the summer of 1981, the Department of Defense requested Congress to increase the maximum enlistment bonus from \$5000 to \$10,000 for a four-year term of service, and it asked for new authority to pay a smaller bonus for a three-year term of service.

The two houses of Congress differed on this proposal. As a compromise, the conference committee settled on a program providing for (1) a maximum \$8000 bonus for a four-year enlistment and (2) a maximum \$4000 bonus for a three-year enlistment, on a test basis only and limited to high-quality recruits entering Army critical skills. The Uniformed Services Pay Act of 1981 authorized these changes, and the conference report accompanying the legislation directed the Secretary of Defense to institute a test of the full range of the new bonuses, modeled on the previously completed Educational Assistance Test.¹¹ The Enlistment Bonus Test was the result.

⁸U.S. House of Representatives, Committee on Armed Services (1981).

⁹Fernandez (1982) summarizes the history of educational benefit programs in this period.

¹⁰Under the Veterans Educational Assistance Program, any enlistee could contribute up to \$2700 to an educational fund; the government then matched those contributions \$2 for \$1. The Army College Fund allowed the Army to add an extra amount (a "kicker") up to \$12,000 for high-quality recruits in certain skills. See Fernandez (1982) for details.

¹¹U.S. House of Representatives, Conference Report (1981).

POTENTIAL EFFECTS OF THE BONUS ON THE ENLISTMENT PROCESS

The new bonus programs were designed to assist Army recruiting in general, but their effects could be manifested in a number of ways that depend on the sequence of steps in the enlistment process. Before we turn to the design and analysis of the experiment, it is useful to review the steps through which a typical recruit goes before signing a contract to enter the Army.

Initial Contact by a Recruiter

The key agent in the enlistment process is the recruiter; in the Army, this is a noncommissioned officer who is assigned a specific area and a definite quota of recruits to be obtained each month. The recruiter's work is guided by the monthly "mission box" of quotas that the Army Recruiting Command assigns to him, specifying a particular number of high school graduates, seniors, and other types of persons by AFQT category. Over much of the period of interest here, a typical recruiter received a monthly quota of one high-quality and one low-quality recruit.¹² His main activities are to seek out such people, persuade them to apply for Army service, and follow through to ensure that they sign contracts and report for active duty when scheduled.

Application for Enlistment

If the prospect is interested and seems qualified for service, the recruiter will attempt to persuade him to apply for enlistment. To do so, the applicant must first take a three-hour test that produces a number of scores, including his score on the Armed Forces Qualification Test (AFQT). AFQT results are reported in nominal percentile scores, where 50 represents the 50th percentile of a standard reference population. The test also produces various "aptitude area" scores that are used to determine qualification for particular occupational specialties.

If the applicant attains a prescribed minimum on the AFQT, he becomes eligible for the physical examination. In some respects this is a crucial step, for it requires travelling, often a considerable distance, to the Military Entrance Processing Station (MEPS) that covers his area of residence. There are 66 MEPS in the continental United States. At the MEPS, the applicant undergoes a physical examination, and if he passes he normally goes on to talk with a service job

¹²See Dertouzos (1985).

counselor about the opportunities available to him. In recent years, about 90 percent of those passing the physical examination have enlisted in the subsequent 12-month period. Most applicants are quite serious about enlistment by the time they reach that point.

Signing an Enlistment Contract

The job counselor's chief function is to "close" an enlistment contract with the applicant. The counselor has the applicant's record of scores and physical qualifications, and he can access the service's central computer data base showing available enlistment slots during the next 12 months. Slots are represented as scheduled training classes in a particular occupational specialty. Before signing an enlistment contract, the applicant and counselor must agree on a particular specialty, a specific date when training will begin, and other details that govern the training process.

The sequence of topics in the applicant-counselor negotiation may vary, but the critical element is the occupational decision. All Army recruits must sign up for training in a particular specialty, and normally they serve their first term of duty in that occupation. A counselor will often suggest one or more specialties, based on the applicant's qualifications and the Army's priorities; sometimes the applicant has a definite request that becomes the starting point for discussion. The ultimate decision may also depend on the schedule of future training classes and the applicant's willingness to begin training at various dates.

Another critical item to be decided is the term of service. The contract commits to a specific term (two, three, or four years); certain specialties require a four-year term, whereas others may require only a three-year or even a two-year term. In conversations we have observed, the normal sequence is for an applicant to decide on a particular specialty and then to select a term, although in some cases the requirement of a long term affects the specialty choice.

Experimental Issues

This outline of the enlistment process indicates that entering the military is not a single decision made by a recruit at one point in time. Observers have differed about the likely effects of bonuses on this process. A Congressional presumption, for example, was that the larger bonuses should encourage more high-quality young people to enter the Army. The provisions of the new plan also assume that the \$4000 three-year bonus would attract enough new people signing three-year

contracts to offset any tendency of the three-year bonus to draw recruits away from four-year commitments.

The Army's own views have been somewhat different. Army managers have told us that according to their impressions, cash incentives seem to appeal much less than educational benefits to prospects in the early stages of the enlistment decision process. The Army's rationale for bonuses has been based instead on the presumed "distributional" effects of bonuses, namely shifts of enlistees among skills and among terms of service. In the Army view, large bonuses may be expected to produce only small increases in total enlistments, but should generate major changes in recruits' choices of skills.

These differing perspectives could have important policy implications. If, for example, the military should again enter a period of large recruiting shortfalls, the Army view would favor expanding educational benefits rather than bonuses. The opinion of the Department of Defense and some groups in Congress, however, has favored expanding bonuses based on the presumption that they would be a lower-cost means of attracting sufficient numbers of new recruits. The Department of Defense asked Rand to consider these issues and to recommend a design for the experiment that would produce the most precise information within the constraints of the Congressionally mandated program and the budget. In the next section, we describe the design that emerged.

III. DESIGN OF THE EXPERIMENT

Like the previous Educational Assistance Test, the Enlistment Bonus Experiment was implemented by offering the new programs, along with a baseline or control program, in separate sets of balanced and dispersed geographic areas (called "test cells"). With such a design, the effect of each new program can be estimated by comparing results in that program's areas with the results in the control areas. To facilitate comparisons and maximize precision, the areas served by each program are matched as closely as possible on the basic factors that might be related to the outcomes. The essential features of the design process are that (1) the experimental programs differ in ways that clearly represent the underlying phenomenon to be studied and (2) the programs are assigned to equivalent groups of areas. In this section we explain the nature of the programs tested and the assignment methodology that we adopted.

PROGRAMS TESTED

Decisions about the exact programs to be tested were based on direction from Congress and guidance from the Department of Defense. First, the Congressional conference report stipulated that the test programs had to represent "the full range of bonuses made available" by the new legislation. Therefore, at least one experimental condition had to include the \$8000 bonus for four-year enlistments and one had to include the \$4000 for three-year enlistments. We recommended that the effects of the two types of bonuses be estimated separately, since there was some concern that the three-year bonus might reduce four-year enlistments.

Second, the Department of Defense decided that the new bonuses should be tested only in the Army and should be offered only to high-quality recruits. This constraint was essential for the three-year bonus, since the legislation explicitly restricted the three-year bonus to Army high school graduates with AFQT scores of 80 or higher. Because the other services were having only slight recruiting problems and did not express interest in paying higher bonuses, the test was confined to the Army.

Third, the Army proposed to limit the test to those skills that qualified for the \$5000 bonus. The list is given in App. A. All of the skills are directly combat-related, and the number of enlistees in the three

primary combat specialties—infantry, armor, and artillery—represents about 85 percent of the total enlistees in this group of skills. Strictly speaking, therefore, the test results represent the impact of bonuses on combat specialties.

Fourth, the Department of Defense and the Army determined that the minimum bonuses to be tested should be those available under the baseline program before the experiment began. Because of the tight recruiting situation at the time, the Army was not willing to reduce bonuses in any test cell. In effect, the relevant policy alternatives were (1) grant larger bonuses and (2) maintain the current program. The test was set up to estimate the effects under only this range of alternatives. Therefore, the test did not address the issue of bonuses vs. no bonuses; the issue was larger vs. smaller bonuses.

TEST CELLS

The result of these constraints was the set of "test cells" exhibited in Table 4. Under this plan the control cell, or Cell A, maintained the preexisting program in areas covered by 70 percent of the nation's youth population. In those places, the Army continued to offer the \$5000 bonus to high school graduates with qualifying AFQT scores, provided they signed contracts for four years in an eligible skill. As before, no bonus was offered for a three- or two-year enlistment in those skills. Bonus offerings for all other skills remained as they had been before the test.

Each of the two new test programs was offered in areas that covered approximately 15 percent of the national youth population. The B Cell program provided an \$8000 bonus for the test-eligible skills, instead of

Table 4
TEST CELLS

Test Cell	Percent of Nation in Test Cell	Bonus Amount (\$), for High- Quality Recruits Entering Test-Eligible Skills		
		Four Years	Three Years	Two Years
A	70	5000	0	0
B	15	8000	0	0
C	15	5000	4000	0

the \$5000 amount offered in Cell A. Otherwise all enlistment incentive offerings were exactly the same between the cells. Therefore, comparisons between the A and B Cells show the effect of changing the test-eligible skill bonus from \$5000 to \$8000.

The C Cell program added a \$4000 bonus for a three-year enlistment in a test-eligible skill. Thus, in the C Cell each potential recruit considering a test-eligible skill had three choices: he could enlist for four years and receive the \$8000 bonus; enlist for three years and get the \$4000 bonus; or commit for only two years and forgo the bonus entirely.

ASSIGNING AREAS TO TEST CELLS

A crucial part of the experimental design process is the assignment of areas to experimental conditions or cells. The fundamental principle is randomized assignment of units (areas) to test and control cells. A strong advantage of randomization is the statistical control it provides; if assignment is randomized, one can calculate the probability that the mean value of any variable in any cell will deviate from the mean in another cell by a specified amount. The more units that can be assigned to each cell, the lower will be these probabilities. Hence, in a randomized experiment, one has some a priori confidence that the characteristics of the experimental units are balanced across test cells *for any variable, even those that are unmeasured*. This increases confidence in the results because it implies that when a difference is observed between cells, the difference is less likely to be due to extraneous characteristics of the units.

We assigned MEPS areas at random to test cells, but we did so based on a statistical model that also imposes matching or balancing constraints on certain variables. Intuitively, the reason for balancing was to ensure that no design was selected which exhibited an undesirable divergence across cells on certain critical variables. The balancing variables we considered and their values in the final design are listed in Table 5.

We selected balancing variables that could be measured during the year immediately preceding the experiment and that might be expected to exert an important influence on the number of Army enlistments during the experiment.¹ We placed primary importance on matching

¹Most features of the Army's recruiting incentive program were deliberately kept uniform across the test cells during the experiment, and therefore we did not need to balance on them. For example, levels of nontest bonuses and all educational benefit programs were offered equally in all areas of the country.

Table 5
TEST CELL BALANCING

Balancing Variable ^a	Value, by Cell		
	A Cell	B Cell	C Cell
Male high-quality enlistments, per 100 males age 17-21 in population	1.14	1.14	1.13
Unemployment rate (number unemployed per 100 in labor force)	7.69	7.66	7.45
Wage ratio (civilian hourly pay divided by military hourly pay)	1.48	1.52	1.48
High-quality military available persons, per 100 population	15.25	15.22	15.23
Nonwhite persons, per 100 population	14.80	16.37	16.22
Number of Army recruiters, per 1000 population	0.87	0.89	0.89
High-quality recruiting quotas, per 100 population	1.21	1.18	1.18
Percent of cell population in East	28	13	16
Percent of cell population in West	19	12	25
Percent of cell population in South	19	29	22
Population in cell, as percent of total U.S. population	69.1	15.5	15.4

^aFor detailed definitions of variables, see App. A.

the rate of high-quality enlistments across cells. In effect, we assumed that areas that have produced high numbers of enlistments may have stable characteristics that will promote high enlistment rates in the future. We also included two economic variables, the unemployment rate and the civilian-military wage ratio, because they have proven to be significant predictors of enlistments in the past. The Department of Defense estimate of the number of high-quality "military available" male population was included to consider differences across areas in

average test scores and educational attainment. Similarly, we balanced on the percentage of nonwhites in the areas to guard against the possibility of racial imbalances. Possible effects arising from the Army recruiting system were balanced by measuring the number of Army recruiters and the size of the high-quality quota assigned to them. Finally, we attempted to ensure that each cell contained roughly the same proportion of its population in the eastern, western, and southern regions of the country. As Table 5 shows, the design that was finally selected contained test cells that were fairly well balanced on each of the above factors, although it was not possible to equate the regional proportions as precisely as desired.

An important statistical objective of balancing is to improve the precision of effect estimates. The analytic model we employ assumes that the number of enlistments in any area during the test period is a log-linear function of the balancing variables' values for that area. Under these conditions, even if the test cells are unbalanced, an appropriate model will yield an unbiased estimate of the test program effect provided the balancing variables are included in the analysis. However, the imbalance does increase the variance of the estimated test program effect, as compared with the variance that would exist if the cells were perfectly balanced (Haggstrom, 1981). This "inflation" of variances relative to the optimum condition is undesirable, of course, because it reduces the precision of the estimates.

A statistical criterion representing the extent of the variance inflation was developed to minimize imbalances and hence maximize precision. Called MISER, this number represents the minimum percentage increase in the standard error of a contrast to be considered in the analysis.² For example, a simple but important contrast in the bonus test analysis is the difference between the number of enlistments in Cell B and the number in Cell A, after adjusting for previous enlistment levels in those cells. The MISER criterion indicates the percentage difference between the standard error of this contrast for a given assignment of units and the standard error that would be observed if both cells had the same means on all balancing variables. The criterion can be used, therefore, to judge the extent to which the candidate assignment is imbalanced.

We employed the MISER criterion as follows. An initial assignment or "design" was generated by assigning each MEPS area at random to one of the two new program test cells, with probability proportional to the size of its youth population. When random assignment had

²For a discussion of the criterion and its application in the bonus test design, see Press (1985).

produced a design meeting the cell size constraint (15 percent of the national population), the differences between the cell means and the total U.S. mean for each balancing variable were examined. For each balancing variable, the difference was required to be less than a fixed tolerance level.³ If the design failed that test for any variable, it was discarded as presumably too imbalanced for further consideration.

Through the above process we generated 20 candidate designs that passed all the tests. For each of those 20, we calculated the MISER value for two contrasts, those comparing Cell B and Cell C with Cell A. MISER values ranged from 3 to 11 percent in all cases. We then selected the design with the minimum average MISER value across both contrasts. As a consequence, the selected design was nearly optimal based on the criteria considered.

A map of the test areas is displayed in Fig. 1. A prominent feature of this design is the dispersion of MEPS areas within each test cell. Such dispersion provides protection against extraneous factors that might complicate comparisons among cells. For instance, if after the experiment began there was a shift in some important variable in one region—say, a sharp rise in unemployment in the industrial Midwest—the change would tend to affect each of the test cells in approximately the same fashion. Although there is no guarantee that all changes during the experimental period will be related to factors that were originally balanced in the design (such as geographic location), the initial balancing provides considerable protection against many types of imbalances that otherwise would flaw the analysis.

EXECUTION OF THE TEST

The test schedule and implementation procedures were driven largely by Army constraints. The Army wanted to hold the additional expenditures for test bonuses to \$10 million annually. Based on our bonus cost estimates, we determined that to hold expenditures within that limit, the new bonuses could be offered in no more than 30 percent of the nation (thus, each test cell included 15 percent). To achieve a reasonable degree of precision, we recommended that each test program run for 24 months. This recommendation was accepted and the test began at the start of July 1982, running through June 1984.

The test was implemented by notifying recruiters, job counselors, and other Army recruiting staff of the new programs through briefings,

³Generally, this tolerance level was established through experience showing that deviations of that size or greater would lead to very large and unacceptable MISER values.

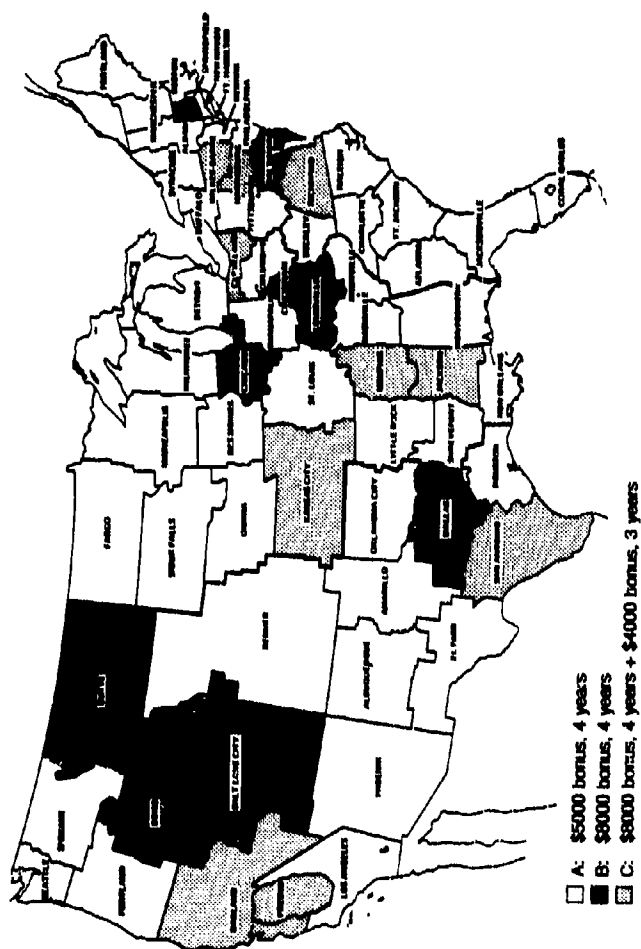


Fig. 1—Areas in the Enlistment Bonus Test

teletype messages, and letters of instruction from higher headquarters. Recruiting guides and manuals were updated to represent the new bonus offerings. To determine whether recruiters actively used the new bonuses in their dealings with prospects, our best source of information is a spring 1983 survey of military service applicants, in which the Department of Defense followed up a representative sample of people who had taken the ASVAB in the preceding two months. The survey data suggest that recruiters did use the bonuses in their "sales talks" with prospects; 65 percent of high-quality Army respondents reported that their recruiter had discussed the bonus with them.⁴

The Army also took steps to advertise the new bonuses to the general youth population. During the experiment the bonus was advertised widely in direct mail packages sent to high school seniors; color brochures and postage-paid business reply cards promoting the bonus were sent to a mailing list of about 1.5 million seniors each year.⁵ In addition, the Army's advertising agency provided each recruiting battalion with a kit for local bonus advertising, including newspaper "glossy" ads, radio tapes and scripts, and press releases with messages specific to each test cell. We verified that the battalions did, in fact, place bonus advertising in their local media; an examination of all local advertising purchases during the experiment showed that ads carrying a bonus theme accounted for about \$400,000 per year in advertising expenditures, which were appropriately balanced across the test cells.⁶ It was not possible, however, to advertise the bonuses through national media such as television networks and magazines, because one cannot direct specific messages for each test cell into appropriate locations using those media. This restriction on advertising may have limited the youth market's awareness of the new incentives.⁷ If so, a permanent nationwide bonus program with full-scale advertising might produce larger effects than we estimate from the test.

⁴Personal communication from Bruce Orvis and Martin Gahart, The Rand Corporation, based on work in progress.

⁵Three different packages, identical except for their references to the \$5000, \$8000, or \$8000/\$4000 bonus plans, were developed and sent to addressees in the appropriate test cell locations.

⁶Bonus theme advertising nevertheless represented only a small fraction of total local advertising (about 8 percent for bonuses, compared with 40 percent for the Army College Fund).

⁷Knowledge of bonuses, military pay levels, and other enlistment incentives is sketchy in the general youth population. For example, a September 1984 national survey of young men showed that only 20 percent of the sample knew that the Army offered a cash enlistment bonus. By comparison, only 29 percent could give a reasonably accurate estimate of starting military pay, and only 39 percent were aware that the Army had an educational benefit program (Bray et al., 1985).

IV. ANALYZING THE ENLISTMENT PROCESS

STAGES IN THE ANALYSIS

We will analyze the possible effects of the bonus programs in three stages, representing the separate but related stages in the enlistment decisionmaking process.

1. Deciding whether to enlist (signing an enlistment contract)
2. Selecting a skill for training
3. Choosing a term of enlistment (deciding among commitments of two, three, or four years)

These three stages are depicted in Fig. 2. Bonus effects at the first stage represent so-called "market expansion" or enlistment supply

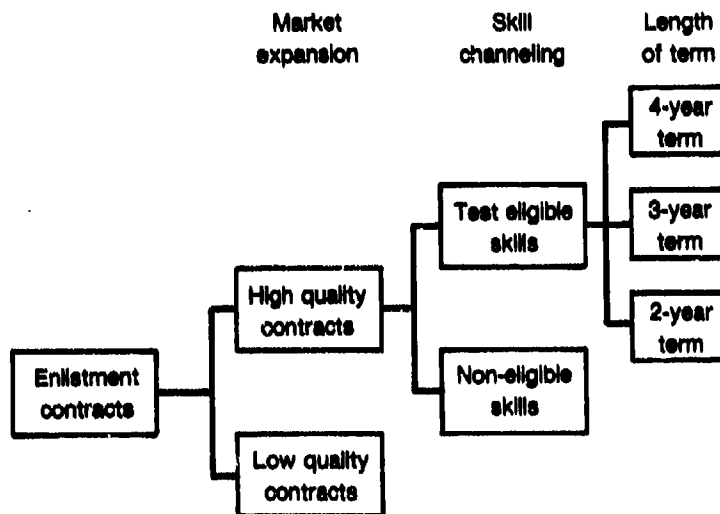


Fig. 2—Stages in the analysis

effects; as we discuss below, such effects can appear as changes in either high-quality or low-quality enlistment contracts. Effects at the second stage we term "skill channeling." To analyze them, we use a model that examines the skill choices of high-quality people who signed enlistment contracts, assessing the degree to which the bonus program led them to select test-eligible rather than noneligible skills. Conceptually, our approach is similar to modeling the percentage of high-quality enlistees who chose eligible skills. If the program had a skill channeling effect, we should observe movements of recruits into test-eligible skills from other skills, *after controlling* for any overall market expansion effect.

Similarly, we will examine the term of enlistment choices made by high-quality recruits who enter eligible skills. That analysis holds constant the number of high-quality enlistees entering eligible skills and seeks to determine bonus effects on lengths of obligated terms, independent of the market expansion and skill channeling effects.

Our most complex analysis concerns the first stage in the process. The remainder of this section explains our approach to analyzing the effects of bonus programs in stage 1. Since the first-stage method directly affects the second- and third-stage analyses, we defer discussing the latter until Sec. V.

BASIC ANALYSIS STRATEGY

The basic data for the Enlistment Bonus Experiment consist of two types of observations: (1) counts of high-quality and low-quality enlistments, by skill group and term of service and (2) measures of several "covariates"—characteristics of the areas that affect the level of enlistments. We measured these variables monthly by MEPS areas, for each month of the two-year test period and for a one-year base period before the test.

Our approach follows a basic paradigm of experimental analysis, comparing counts of enlistments in the experimental cells with counts in the control cell, while adjusting for any measurable extraneous factors that could affect the results. If the test design could equate the cells on all factors other than bonus offerings, a simple cross-cell comparison would yield an unbiased estimate of the effects of the bonuses. However, complexities in both the test and in the real-world recruiting system make such a simple analysis inappropriate. Instead we have developed a more elaborate model that employs (1) differences between the test and base periods, (2) adjustments for changes in exogenous

factors that affect enlistment supply, and (3) a system of simultaneous equations representing the behavior of recruiters as they react to supply changes.

The first aspect of the model—the use of differences between test and base periods—is based on our desire to control some factors that could not be fully balanced in the experimental design. There are several reasons for concern that some imbalances may exist across test cells despite the matching that was done. First, with the small number of MEPS areas available for assignment to test cells, randomization may not have matched the cells on unmeasured variables as precisely as one would like. Second, we know that the matching left some imbalances on variables that were considered (e.g., regional distributions of the test cells were not perfectly matched). Third, we may have omitted some important variables or measured them imperfectly.

We have dealt with these problems by adopting a change measure as the fundamental outcome variable. That is, our basic outcome measure is not the absolute level of enlistments, but rather the *change* in enlistments between (1) the preexperimental base period, when all cells offered the same bonus program and (2) the test period, when the cells offered varying programs.¹ Table 6 illustrates the procedure using hypothetical data for a “typical” MEPS from each cell.

Table 6
ILLUSTRATIVE COMPARISON OF ENLISTMENTS
IN TEST CELLS
(Hypothetical data)

Test Cell	Base Period	Test Period	Number of High-Quality Enlistment Contracts in a Typical MEPS	
			Ratio, Test to Base Period	Log-Difference ^a
A	100	120	1.20	.182
B	100	126	1.26	.231
C	100	132	1.32	.278

^aDefined as $\log(t) - \log(b)$, where t = test period enlistments and b = base period enlistments.

¹This approach was first adopted in defense experiments by Haggstrom et al. (1981).

Suppose that we observe the MEPS areas in the control cell during the base period and find that a typical area produced 100 high-quality enlistments per month, rising to, say, 120 enlistments per month during the test period. We compute the ratio of the test to the base period rate, 1.2. Note that we also compute the logarithm of this ratio ($\log 1.2 = .182$), which is identical to the difference between the logarithms of the enlistment counts ($\log 120 - \log 100 = .182$). This "log-difference," a measure of change, will be the outcome variable in the simultaneous equation model to be developed below.

The ratio of 1.2 in the control cell suggests that factors unrelated to bonuses led to a 20 percent increase in recruiting supply, since bonuses remained constant in the control areas. The increase might be due to a number of extraneous factors, such as a change in national economic conditions, improvements in recruiting management, or international events that motivate more young people to enter the military.² The change in the control cell may be compared with the larger hypothetical increases illustrated for the B and C Cells, 26 and 32 percent, respectively. The differences between these increases and the 20 percent increase observed in the A Cell represent the effects of the test programs, provided that no other factors changed differentially across the cells. Of course, this example is oversimplified, because in the actual analysis we will model each MEPS separately in terms of log-differences, but the example illustrates the basic logic.

The change-analysis approach has the advantage that it "nets out" any differences between areas that are stable over time and that might be present even though we tried to balance the cells. Suppose, for instance, that despite our best attempts at preexperimental balancing, the B Cell contained a higher proportion of rural population than the A Cell. If rural dwellers were more likely than urban dwellers to enlist, the main effect of rural residence would lead a higher enlistment rate in the B Cell than in the A Cell during both the test period and base periods. Omitting the rural residence variable would bias the results in an absolute-level model, but in the change model the log-differencing removes the bias.³ Many of the basic characteristics of areas that affect results in nonexperimental studies are features of the underlying population, economic structure, or local culture. Over a fairly short period

²The method also automatically controls for any nationwide changes in military recruiting policies. For instance, suppose military pay were increased, or eligibility standards for educational benefits were relaxed. Since these changes would be implemented uniformly across the nation, their effects would appear equally in the test cells and be taken out by the method of cross-cell comparison.

³See Haggetrom et al. (1981) or Fernandez (1982) for the underlying assumptions and the derivation of this result. The key assumptions are that all effects in the model are multiplicative and that area-specific effects are stable between the base and test periods.

of time, these factors—such as population demographics, the nature of local industry, or local “tastes” for military service—are likely to remain constant relative to other areas. Thus, the log-difference method automatically controls for many factors that need to be explicitly modeled in other kinds of studies.

ADJUSTING FOR CHANGES IN COVARIATES

The simple comparison of test cells, coupled with use of a change variable, adjusts for national trends and stable characteristics of local areas. However, it does not consider potential changes in time-varying factors that occur nonsystematically or differentially across areas. Our approach considers such changes by modeling the change in enlistments for each area as a function of changes in exogenous variables, or “covariates.”

The analysis considers two broad classes of covariates: features of the civilian economy and features of the recruiting system. A major reason for measuring these factors is that they could change differentially in different MEPS areas between the base and test periods. For instance, cyclical changes in business conditions are likely to affect areas dependent on the automobile industry, such as Michigan, more strongly than other areas. Similarly, if the Army increases its number of recruiters or advertising in a nonuniform fashion across areas, the changes could bias the model coefficients that represent bonus effects.

Table 7 lists summary statistics for the covariates by test cell. We selected these variables because they represent the principal area characteristics that are theoretically related to enlistments and that are measurable at the level of detail we need (MEPS area by month). For each variable, monthly observations were obtained for the smallest available reporting areas. In most cases, the reporting areas were different from MEPS areas, so we weighted or reaggregated the measures to conform to MEPS boundaries.⁴

⁴We weighted areas by disaggregating the reporting areas (such as states or Army Recruiting Districts) into segments whose boundaries corresponded to those of MEPS areas, apportioning reported totals to segments in proportion to 1980 Census populations where necessary. We then recombined the segments into MEPS areas, again using population figures as weights where appropriate.

Table 7
COVARIATE VALUES DURING BASE AND TEST PERIODS

Covariate	Annual Rate, by Time Period and Test Cell					
	Base Period			Test Period		
	Cell A ^a	Cell B	Cell C	Cell A ^a	Cell B	Cell C
1. Unemployment rate (average, in percent)	8.61	8.46	8.36	9.36	9.17	9.36
2. Civilian wage rate (average, in dollars per hour)	8.32	8.69	8.38	8.94	9.30	8.98
3. Recruiter strength (average number of recruiters on production, per month)	752	798	744	754	765	735
4. Recruiter quotas (annual total)						
High-quality	5873	5900	5955	5925	5656	5533
Low-quality	9473	9118	9420	9663	8562	8571
5. National advertising (annual total expenditures, in thousands of dollars)	2230	2268	2246	3351	3164	3220
6. Local advertising (annual total expenditures, in thousands of dollars)	725	724	762	804	685	574

^aCell A totals for items 3 through 6 have been adjusted to reflect the totals that would be observed if Cell A were the same size as the other cells (about 15.5 percent of the nation). That is, the Cell A totals displayed here are the true totals multiplied by the fraction (.155/.691).

COVARIATE DEFINITIONS

Unemployment and Wage Rates

The unemployment rate represents the number of persons not employed but available for work, as a fraction of the total labor force. It is estimated from large monthly surveys of the civilian population. The wage rate is measured by the average hourly earnings of

production workers in manufacturing industries, estimated from monthly reports of employers. Both items were taken at the state level from reports of the U.S. Bureau of Labor Statistics (*Employment and Earnings*, various issues). Both measures have the disadvantage of applying to a much larger population than the prime recruiting group (young males). However, they are the best measures available for MEPS-size areas on a monthly basis, and we assume that at the aggregate level they are well correlated with the age- and sex-specific rates that we would prefer to measure if the data were available.

Number of Recruiters

Counts of the number of production recruiters in each area were provided quarterly by areas covered by Army Recruiting Command battalions. These areas (formerly known as recruiting districts) are approximately the size of states, and their boundaries largely coincide with those of MEPS. Where the boundaries did not coincide, we weighted the counts appropriately, and we assumed that the reported quarterly value was constant for each month within the quarter.

Recruiting Quotas

Quotas for high-quality and low-quality recruits were reported quarterly by each battalion. We estimated the monthly quotas as one-third of each quarter's total and weighted the figures where necessary to reflect MEPS boundaries.

National Advertising

The majority of the Army's advertising is carried by major media that are bought on a nationwide basis. These media include network television, network radio, national magazines, and certain "spot" purchases of individual broadcast stations that are part of a national plan. We obtained measures of the total national cost of such purchases, by month, from N. W. Ayer, the Army's advertising agency. The data also showed the monthly number of *impressions* achieved by the advertising, a measure of audience delivery, by Area of Dominant Influence (ADI).⁵ We allocated the total national costs for each medium

⁵One impression is an exposure of an individual to one message. Impressions are estimated from sample surveys of the population in which the respondents keep records of their television viewing, radio listening, magazine reading, and so forth. The standard reporting areas for such data are ADIs, groups of counties in which each county is assigned to the ADI whose television stations capture the predominant audience in the county.

across ADIs according to the number of impressions achieved in that medium for that month, and then aggregated the allocated costs to MEPS level.⁶

Local Advertising

The other major Army media program is local advertising, which consists of media purchases made directly by individual Army recruiting battalions to supplement the national program.⁷ N. W. Ayer provided records of each local advertising purchase, from which we extracted summaries of the total expenditures on local advertising by month by battalions. These expenditures were then summarized and weighted to the MEPS level.

As Table 7 shows, at the cell level the covariates moved generally in parallel directions over time. However, a few modest divergences can be seen. For example, the C Cell unemployment rate rose proportionately more than the other two cells between the base and test period; national advertising expenditures rose proportionately less in the B and C Cells than in the A Cell; and C Cell local advertising dropped relative to the A Cell. As we will show, these variables are related to the level of enlistments, so it is important to control for such variations.

CONTROLLING FOR RECRUITER BEHAVIOR

Thus far, we have considered possible effects on the experimental outcomes from factors that influence the *supply* of recruits. Now we consider some demand effects—in particular, effects arising from the behavior of recruiters, who play a central role in the process. For the analysis of the bonus experiment, it appeared especially important to consider recruiter behavior, because the test was conducted during a

⁶The impressions data omitted certain types of media for which Ayer does not obtain impressions data (primarily syndicated groups of stations and media serving minority ethnic groups, each of which represents about 10 percent of the national advertising budget). Since we could not allocate these costs by area, we omitted them from the analysis.

⁷The Army also advertises to high school seniors and recent graduates by direct mail, although the expenditures on the mail program are much smaller than on the media (approximately \$500,000 for mail and \$30 to \$40 million for media). We attempted to obtain detailed data on direct mail packages mailed out to local areas; however, the agency was unable to obtain information on all of the mailing waves, and we decided not to include the partial information in the bonus test data base. Among those mailings for which data were available, preliminary analysis showed the area distribution was very closely balanced across MEPS areas and test cells.

period of unprecedented recruiting success. During 1982 and 1983, Army recruit quality levels reached all-time highs, and field reports suggested that recruiters were achieving success more readily than before. Under these conditions, some observers questioned whether bonus-induced increases in the supply of available recruits would really be translated into rising enlistments. Perhaps, instead, an increase in supply would make it easier for recruiters to meet their quotas, after which they could reduce their effort. Therefore it seemed important to consider recruiters' level and direction of effort in the model.

By allocating time differently in response to quotas, award programs, and other incentives, recruiters can affect both the quality and quantity of people who volunteer for service. Until recently, enlistment research has treated supply issues without paying explicit attention to the role of recruiters in the enlistment process. For example, changes in recruiter effort have not been considered, and it has been implicitly assumed that obtaining low-quality enlistees requires virtually no effort from the recruiter. However, our observations of actual recruiting stations suggest that recruiters continually make decisions about how to spend their time, and that these decisions have important effects on enlistment rates. We next outline the possibilities conceptually.

Recruiter Choices and Effort

In general, recruiters can influence enlistment outcomes by altering both the direction and intensity of their effort. Figure 3 illustrates the choices that face an individual recruiter or a recruiting battalion.⁵ The solid line closest to the origin in Fig. 3, labelled "pretest," represents a range of hypothetical choices available to a recruiter as a function of the initial level of economic variables and recruiting resources. This recruiting tradeoff curve indicates all combinations of high-quality (H) and low-quality (L) enlistments that the recruiter can achieve. He can move along this curve in either direction. By engaging in certain types of activities—such as cultivating contacts with high school seniors, attending "career day" programs, or visiting science fairs—a recruiter can move along this curve and secure more high-quality individuals. Or, conversely, he can move down the curve by spending time in the station with "walk-ins" or youth counselling referrals. Here more low-quality recruits are obtained, but at the expense of the higher-quality

⁵Virtually all of our modeling assumptions apply equally to individual recruiters and aggregates of recruiters such as battalions. There are 56 battalions in the Continental United States, each responsible for an area roughly the size of a state. In the analysis, the data have been transformed from battalions to MEPS areas.

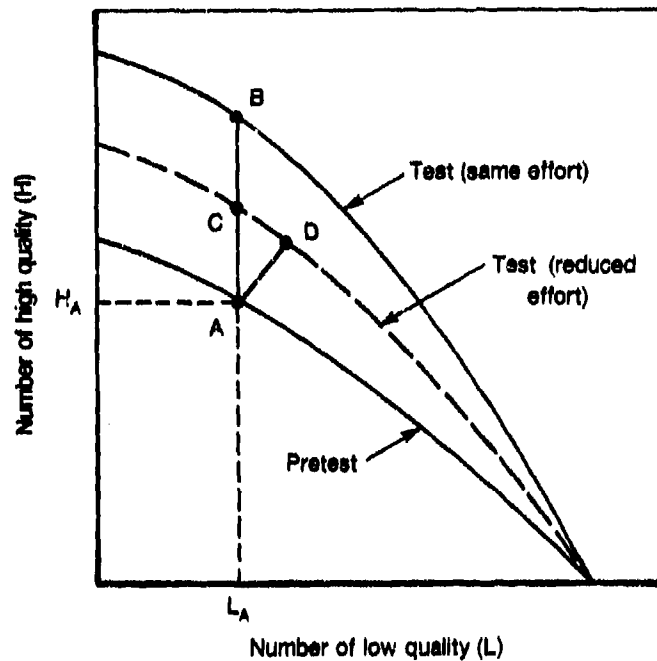


Fig. 3—Potential effects of recruiter choices on bonus results

youths. The ultimate mix of enlistments chosen will depend on the incentives he faces and the relative rewards for securing different categories of enlistments. For illustrative purposes, let us assume that he moves to point A, representing H_A high-quality recruits and L_A low-quality recruits, respectively.

A changing economic or social environment or level of recruiting resource expenditures alters the range of feasible outcomes facing recruiters. For example, because the bonus test causes larger enlistment bonuses to be offered, recruiters will be able to secure increased numbers of enlistments. Suppose, for the time being, that recruiters continue to put forth the same level of effort as they did before the test began. The new level of enlistment supply, reflected in choices

available to the recruiter, is indicated by the outermost solid line in Fig. 3. Of course, the observed effect of the larger bonuses on high-quality enlistments will depend not only on the magnitude of the shift in potential supply, but also on the allocation of effort among various recruiting activities. For example, the observed bonus effect on high-quality contracts will be dampened if recruiters decide to simultaneously increase enlistments in lower-quality categories. Since identical outward shifts in supply can result in a variety of actual outcomes, test and pretest comparisons must control for movements along the tradeoff curve. Thus, we wish to identify point B, representing the potential increase in high-quality enlistments, holding the number of low-quality individuals constant.

In addition to holding low-quality enlistments constant, the movement to point B assumes that recruiters have incentives to maintain the degree of effort at the pretest level. However, there is compelling evidence that recruiters lack strong incentives to exceed quotas (see Dertouzos, 1983, 1985). Although achieving goals ("making mission") is viewed as essential for career advancement, *overproduction* has a distinct disadvantage: future quotas may be increased in response to present success. If this is true, recruiters might respond to the increase in the supply of enlistments by reducing their effort. The resulting range of choices, at the lower level of recruiting intensity, is represented by the dashed line falling between the initial tradeoff curve and the range of outcomes that would be feasible with constant effort.

Thus, even after controlling for the direction of recruiter effort, the resulting increase in high-quality enlistments, indicated by point C, may significantly underestimate the potential increase to point B. Of course, if recruiters have incentives to secure additional low-quality enlistments, the observed outcome would be at a point such as D, representing even fewer high-quality enlistments. Consequently, the measured bonus effect can be quite small even though the latent supply effect is significant. The degree of divergence between D and B will depend on levels and changes in quotas for different categories of recruits as well as the incentive systems in place during the initial and bonus test periods. However, the importance of recruiter behavior remains an empirical question pending our analysis below.

Modeling Recruiter Behavior and Enlistment Supply

Based on the above conceptual framework, we developed a simultaneous equation system to represent the joint effects of recruiter behavior and enlistment supply. The key features of our model are

described in Table 8.⁹ It begins by postulating that recruiters' welfare depends upon the number of enlistments, quotas, and the effort expended. Formally, we can express a recruiting battalion's objectives or "utility" as follows:

$$U = U(E, H, L, Q_H, Q_L) \quad (1)$$

where E represents an index for effort,

H is the number of high-quality recruits,

L is the number of low-quality recruits,

Q_H is the quota for high-quality recruits, and

Q_L is the quota for low-quality recruits.

Since recruiters and battalion commanders are evaluated on the basis of the number of enlistments relative to quotas for each category, welfare is positively related to H and L, and negatively related to quotas. In addition, at a given level of achievement, recruiter welfare will be negatively related to the amount of effort required.

Now, recruiters are constrained in their maximization of objectives by the available supply of enlistments. Supply of both high- and low-quality recruits will depend on economic variables such as the unemployment rate and civilian wage rate as well as on recruiting resource

Table 8

KEY FEATURES OF THE CONTRACT MODEL

Quantity	Depends On
1. Magnitude of recruiter effort	High- and low-quality enlistments relative to quotas
2. Relative reward for high- and low-quality enlistments	High- and low-quality enlistments relative to quotas Monthly dummy variables representing centralized changes in management policy
3. Enlistment supply	Economic variables Resource expenditures, including bonuses
4. Observed enlistments	Simultaneous interaction of supply factors Magnitude and direction of effort

⁹This model represents the first stage of the enlistment decisionmaking process, as described in Fig. 2. The models representing the subsequent stages are specified in Sec. V.

expenditures, including recruiter numbers and advertising. In addition, the number of enlistments will be affected by the level of effort.

Following previous research, we specify enlistment supply as

$$\log(H) = \lambda \log(L) + \beta X + \log(E) \quad (2)$$

where X represents a vector of exogenous supply factors, including indicator variables representing the test cells,

λ represents the feasible tradeoff between high- and low-quality categories of recruits, where $\lambda < 0$, and

E represents the index of effort.

Since actual hours and intensity of work are not directly observable, the index E is defined on the basis of a baseline level of effort. That is, for the initial period the index is equal to one and the supply expression reduces to the usual characterization since $\log(1) = 0$. Changes in effort from the baseline are measured in units representing the resulting changes in enlistments, holding exogenous supply factors constant. For example, a 10 percent decline in effort, $E = .9$, results in an equivalent decline in enlistments. Of course, this effort index cannot be considered to be a metric representing actual labor or time devoted to recruiting. In all likelihood, enlistment outcomes are not linearly related to time or labor inputs because of diminishing marginal productivity. For the range of outcomes generally observed, the index E represents percentage deviations of observed enlistments from ranges of outcomes that would have been possible at constant levels of effort.

Although E is not observable, we can estimate the underlying supply relationships by assuming that the level of effort depends upon how well the battalion is performing relative to quotas. That is,

$$\log(E) = \gamma_1 \log(H/Q_H) + \gamma_2 \log(L/Q_L) \quad (3)$$

Negative values for γ_1 and γ_2 imply that effort is reduced continuously as a function of the ratios of enlistments to quotas. If the bonus experiment increases enlistments, some recruiters, finding it easier to achieve goals, may have few incentives to work as hard as before.

Continuity of Recruiter Effort

An important issue is whether the relationship between effort and contract production, expression (3), is continuous. Some characterizations suggest that when a recruiter or his battalion reaches the quota, effort and production will drop abruptly or cease. This was the hypothesis underlying the concern, mentioned earlier, that a bonus increase might not lead to a corresponding increase in enlistments if

recruiters were making their quotas easily. To examine that issue, we obtained empirical data on the performance of individual recruiters under various conditions of battalion success or failure. For example, Table 9 illustrates a rather smooth shift in recruiter performance distributions as a function of aggregate battalion outcomes. Battalion performance is indicated by the ratio of the number of high-quality enlistments divided by the quotas for that category. A ratio under 1.0 means that the battalion is not securing the aggregate monthly requirement for the most desirable categories of recruits. We see that in such battalions nearly 60 percent of all recruiters are failing to write sufficient contracts to achieve their individual missions. On the other hand, 10 percent just barely make their goals whereas about 30 percent exceed the goal.¹⁰

As battalion outcomes improve, we can observe a smooth and continuous increase in the number of recruiters making and exceeding their goals for enlistments. For example, for battalions exceeding the high-quality goal by 40 percent or greater, about 50 percent of individual recruiters still failed to secure sufficient numbers of enlistment contracts. About 40 percent of the recruiters were now exceeding quotas, about 10 percent more than those from battalions that were falling on an aggregate basis.¹¹ Thus we find wide variation in individual

Table 9

INDIVIDUAL RECRUITERS AND BATTALION PERFORMANCE: 1983

Battalion Production Ratio ^a	Percent of Individual Recruiters		
	Missing Mission	Making Mission	Exceeding Mission
0.0-0.9	59	10	30
1.0-1.1	56	12	33
1.2-1.4	52	11	37
Over 1.4	49	11	40

^aThe production ratio is defined as the number of high-quality persons recruited by the battalion, divided by the total battalion mission for that group.

¹⁰For these tabulations, individual goals were assumed to consist of one high-quality and one low-quality enlistment. Subsequent tabulations, based on more complicated notions of "mission box" goals, yield identical qualitative results.

¹¹An examination of these data, along with an understanding of a recruiter reward system that requires excess production over a six-month moving "window," has impor-

recruiters' performances regardless of the aggregate battalion ratio of high-quality enlistments to quotas.

Estimating Model Parameters

With the above characterization of recruiter effort, we can derive a "quasi-reduced form" expression for high-quality recruits by substituting Eq. (3) into the structural supply relationship Eq. (2). That is,

$$\log(H) = \alpha_1 \log(L) + \alpha_2 X + \alpha_3 \log(Q_H) + \alpha_4 \log(Q_L) \quad (4)$$

where $\alpha_1 = (\lambda + \gamma_2)/(1 - \gamma_1)$,
 $\alpha_2 = \beta/(1 - \gamma_1)$,
 $\alpha_3 = -\gamma_1/(1 - \gamma_1)$, and
 $\alpha_4 = -\gamma_2/(1 - \gamma_1)$.

Expression (4) can be estimated by a two-stage procedure by using the following expression for low-quality recruits:¹²

$$\log(L) = \theta_i + \varphi_1 X + \varphi_2 \log(Q_H) + \varphi_3 \log(Q_L) \quad (5)$$

where i indexes the month of observations and θ_i represents a constant term that is permitted to vary by month.¹³ Simultaneous estimation of this system provides values for the coefficients in expression (4), which in turn permits the identification of the underlying structural parameters.

tant implications for aggregate enlistment models. In particular, models controlling for "demand" influences by assuming a dichotomous behavioral change only at the point of battalion goal achievement are probably not appropriate.

¹²This expression can be viewed as a first-order approximation to the reduced-form equation resulting from the maximization of welfare, subject to the supply constraint (Dertouzos, 1985). An alternative approach would be to derive the expression for low-quality recruits and the relationship between effort and relative production directly. For example, we can specify battalion welfare as

$$U = E^{\delta_1} + (H/Q_H)^{\delta_2} + \delta_3 (L/Q_L)^{\delta_3}$$

where the parameters δ_1 , δ_2 , and δ_3 represent the influence of changes in effort, high-quality production relative to quota, and low-quality production relative to quota. Allowing δ_1 to vary by month controls for changes in policies toward low-quality recruits. Maximizing this expression for battalion objectives provides estimable expressions (4) and (5). Thus, we can identify pure supply effects, such as the bonus program, on the number of high-quality enlistment contracts while controlling for changes in both the level and direction of recruiter effort.

¹³This flexibility is introduced because most significant changes in centralized recruiting policy involve lower-quality categories. Such policies may include limitations on nongraduates or the lowest AFQT scores.

ters.¹⁴ For example, α_3 directly provides an estimate for γ_1 , thereby making it possible to obtain the value for γ_2 , the tradeoff parameter λ , and the vector of underlying supply coefficients of primary interest, β . These supply coefficients represent the changes in high-quality enlistments that result from changes in supply variables, such as the bonuses, holding effort and the number of low-quality recruits constant.

¹⁴By specifying the underlying structure of expression (4), nonlinear computational techniques yield direct estimates of relevant coefficients γ_1 , γ_2 , β , and λ .

V. RESULTS

MARKET EXPANSION EFFECTS

To assess the effects of the bonus programs on the total number of Army enlistment contracts, we estimated expressions (4) and (5) jointly, in log-difference form, using a three-stage least-squares methodology. The coefficient estimates for expression (4), signifying pure effects of bonuses and other supply factors, are reported in Table 10, as are the key coefficients reflecting recruiter choices.

Effects of Bonuses and Other Supply Factors

The effects of the two new bonus programs, compared with the control program, are indicated by the first two coefficients in Table 10. For convenience in interpretation, these coefficients may be converted into corresponding percentage increases.¹ The results show that even though the eligible skills covered less than 30 percent of recruits, the C Cell program had the potential to increase total high-quality Army enlistments by 5 percent. This point estimate is statistically different from zero at the .05 level. Not surprisingly, the B Cell coefficient was somewhat lower, corresponding to a 4.1 percent expansion effect, which is significant at the .10 level. Thus, we can conclude that if the control program were replaced nationwide by one of the test programs—and no change occurred in economic conditions, recruiting staff, Army advertising, recruiting quotas, or recruiters' level and direction of effort—the number of high-quality Army enlistments would increase between 4 and 5 percent.²

It is important to emphasize that the bonus market expansion effects were achieved by a program limited to a fairly small group of

¹For small coefficient values (e.g., less than .10), the coefficient is very close to the corresponding change factor; for example, the C Cell coefficient of .049 corresponds to an increase of 5.0 percent. Strictly speaking, the conversion rests on the observation that, for any dummy variable coefficient estimate c , an expected percentage increase is $\exp(c - .5V(c))$, where $V(c)$ is the estimated variance. See Kennedy (1981).

²Although these increases may seem modest, note that in the context of total compensation, the bonus changes are themselves rather small. In 1983, annual basic military compensation for a newly trained recruit (grade E-3), including pay, quarters, and subsistence allowances, was about \$12,400. At a discount rate of 10 to 20 percent, the present discounted value for a four-year enlistment would be between \$38,000 and \$43,000. Thus the B Cell bonus increase, for example, represents about a 7 percent increase in basic compensation.

Table 10
COEFFICIENTS: MODEL OF HIGH-QUALITY ENLISTMENT
CONTRACTS

Variable	Coefficient	Standard Error	t
Bonus programs			
B Cell (\$3000)	.0400	.0238	1.67
C Cell (\$3000/\$4000)	.0490	.0238	2.06
Unemployment rate	.9424	.0971	16.50
Civilian wage rate	-.5468	.3493	-1.57
Number of recruiters	.5971	.0887	6.73
National advertising (dollars)	.0563	.0134	4.21
Local advertising (dollars)	.0127	.0055	2.26
γ_1 (HQ quota)	-.2762	.0494	-5.59
γ_2 (LQ quota)	.0491	.0378	1.31
λ (tradeoff)	-.3090	.0528	-5.87

NOTE: The coefficient estimates refer to the underlying structural parameters in expression (4) of the text.

critical skills.³ Presumably the bonus impact would be greater if more skills were included, because some people who would not enlist in a combat skill for a bonus would enlist in another skill if the same bonus were offered. That is, the two groups of skills may not be "perfect substitutes" in the eyes of prospects. However, given current data, we cannot predict the precise effect of expanding eligibility to other skills.

The other supply factors in Table 10, economic variables and measures of recruiting and advertising resources, were included primarily as controls to make our estimates of the bonus effect more precise. However, the results hold some interest in their own right. All of these variables have estimates consistent with theoretical expectations and similar to results obtained in previous research. The unemployment rate has a positive and significant effect on high-quality enlistments, with an elasticity of .94. The civilian wage elasticity is estimated to be

³Our definition of market expansion reflects the total increase in high-quality enlistments attributable to individuals' decisions to enter the Army, regardless of which skill they enter. We do not attempt to estimate an "expansion" effect within the eligible skills only, because doing so would require assumptions we are reluctant to make (see App. C).

negative (appropriately, since an increase in the civilian wage rate relative to the military rate should lead to fewer enlistments), although the coefficient is not significantly different from either zero or one at the .05 level.⁴ For recruiters, the estimated elasticity is almost .80, more than six times its standard error. Similarly, both the national and local advertising variables have positive coefficients that are significant at the .05 level.

Recruiter Behavior and Enlistment Supply Tradeoffs

The coefficients for the quota and tradeoff parameters highlight the importance of controlling for recruiter behavior. These results confirm that the recruiter's response to supply changes can significantly alter enlistment outcomes and, consequently, affect estimates of the bonus expansion effect. For example, the estimate of the tradeoff parameter, λ , was -.309, with a standard error of about .053. This result implies a tradeoff of about 3.6/1. That is, recruiting high-quality people is between three and four times as difficult as recruiting lower-quality people.⁵ Therefore, if recruiters face insufficient incentives or rewards to pursue high-quality prospects, they can substitute low-quality, as described in Sec. IV. By including the high- versus low-quality tradeoff in the analysis, we have controlled for this possibility; our estimates of the "pure" enlistment supply parameters hold constant the number of low-quality recruits.

The estimated values for γ_1 and γ_2 indicate that levels of recruiter effort can also vary significantly. The values for γ_1 and γ_2 are the respective elasticities of effort with respect to the enlistment contract production ratios—enlistments divided by quotas—for high- and low-quality enlistments. The relative magnitudes and significance of these coefficients suggest that high-quality enlistments are the primary

⁴The lack of precision may stem from the limited dispersion of year-to-year changes in civilian wages facing recruits in different markets. Also, log-difference models could very well aggravate problems associated with measurement error in some of the supply variables. In fact, reverse regressions for the difference model indicated that the recruiter and wage elasticities may be biased downward in comparison with estimations based on untransformed observations. See Leamer (1978). For estimating the effect of the bonus program, however, the differenced data are more appropriate.

⁵Since a 10 percent decline in low-quality contracts results in a 3.09 percent increase in high-quality contracts, the elasticity estimate can be evaluated using the mean values of the two contract variables (78.9 and 71.0, respectively, as shown in App. A), yielding the calculation $(.10)(78.9)/[(.6409)(71.0)] = 3.6$. This tradeoff estimate is remarkably consistent with those reported earlier (Dertouzos, 1988). The fact that virtually identical results are obtained despite using a log-difference formulation is convincing testimony that the underlying theoretical model is fundamentally sound (Plosser, Schwert and White, 1987).

motivating factor determining recruiter behavior.⁶ For high quality, the elasticity is about $-.28$, suggesting that a 10 percent increase in enlistment supply will result in a 2.8 percent decline in the index of recruiters' effort, if all other factors remain constant. As a result, a 10 percent rise in supply would shift up the *actual* tradeoff curve by only 72 percent of the potential supply increase (see Fig. 3 of Sec. IV), unless quotas are simultaneously raised by the same magnitude.⁷ The model used in our analysis controls for this phenomenon, in the sense that the effects of the supply variables are estimated assuming that the level of recruiter effort remains constant.

Costs of Achieving Market Expansion: Bonuses versus Other Policies

These results can be used to make preliminary estimates of the costs of achieving market expansion through bonuses and other policy options. We caution that the following calculations do not consider all possible effects. A full analysis of the costs and effects of alternative recruiting policies is beyond the scope of this report, and would require considerably more information than we now have. Nonetheless, certain implications of our data may ultimately be useful for a more general analysis of comparative cost-effectiveness.⁸

We consider, first, the marginal cost of obtaining additional recruits through expanding enlistment bonuses. The B Cell result indicates that the Army could achieve a 4 percent market expansion effect by increasing the bonus from \$5000 to \$8000. That 4 percent effect means that the average MEPS can potentially add about 2.8 recruits.⁹

⁶This empirical result is consistent with the formal structure of the recruiting reward system. For a detailed description of this program, see Dertouzos (1985).

⁷We caution that the effort-quota relationship should not be expected to hold under all circumstances. If taken literally, the estimated elasticity of effort implies that effort will always be increased as a function of quotas. Over the range of enlistment/quota ratios actually observed during the bonus test period, this interpretation appears to be correct. (We allowed for further nonlinearities by estimating different elasticities for battalions under their mission, but the implied relationship between effort and production/quota ratios was not statistically distinguishable under different circumstances.) This is a simplification, however, and does not imply that the Army could dramatically increase recruiter effort by significantly raising goals. Faced with an extremely low probability of successfully meeting missions, recruiters might become overworked, discouraged, and actually reduce effort.

⁸The problems of cost analysis are discussed further in App. B, including the reasons why the Department of Defense needs more information before drawing firm conclusions about the comparative costs and effects of recruiting policy options.

⁹From App. A, the mean number of high-quality recruits per MEPS is 71; thus the larger bonus increases the number of recruits by 2.8 ($.04 \times 71$), and the total number of high-quality recruits under the new bonus is 73.8.

However, under the new program the Army must pay an extra \$3000 to all recruits who enter the eligible skills for four years, not just to the "newly attracted" recruits. The total cost of the additional payments is about \$46,500, which works out to about \$16.000 per new high-quality recruit.¹⁰

Similar calculations can be made for recruiters and advertising—provided, again, that we consider only the effect on numbers of recruits. Evaluated at the average number of recruiters per MEPS (see App. A), the recruiter elasticity in Table 10 implies that about 1.8 new recruiters are required for each high-quality enlistment. If we further assume that a recruiter costs about \$3000 monthly (Armor et al., 1982), then it would cost about \$5400 to obtain an additional high-quality recruit by increasing the recruiting staff.

Of course, this calculation ignores recruiter training costs as well as some very complicated issues concerning the role of "opportunity" costs rather than direct budgetary costs. If, for example, a new recruiter, due to Congressionally imposed end-strength constraints, is obtained by reducing Army personnel in an alternative capacity, the appropriate measure is not the cost of compensation. Rather, the equivalent value of the services provided in the alternative capacity is more relevant. Analyzing this more general costing issue is beyond the scope of this study.

In the case of advertising, the elasticities, translated into dollars using the mean advertising levels per MEPS, imply that the marginal cost of obtaining a high-quality recruit is about \$6000 using national advertising and about \$5900 using local advertising.¹¹

These calculations suggest that although enlistment bonuses increase the number of high-quality recruits, they may not be as cost-effective as increases in recruiting staff or advertising, for market expansion purposes. However, we do not know if recruiters or advertising would be as cost-effective for filling critical skills or increasing terms of enlistment. As we shall see below, bonuses have large effects on skill channeling and terms of service. Unfortunately, we lack a practical method of costing such outcomes, and in the case of

¹⁰During the test, about 21 percent of all high-quality recruits entered test-eligible skills for four-year terms. Thus the \$3000 in extra bonuses must be paid to 15.5 recruits ($73.8 \times .21$), at a total cost of \$46,500. This calculation, of course, ignores the possibility of skill channeling, which would drive the cost higher.

¹¹Although these estimates are illustrative, we are aware of a number of sources of error that may affect them. As noted above, they may be biased by the differencing approach because of measurement error. For this reason, they should be regarded as conservatively high estimates of the relative costs. In addition, the simple characterization of advertising's role ignores several important complexities, including nonlinearities, thresholds, and lagged effects.

recruiters and advertising, we lack credible experimental data on the magnitude of the effects.¹² Therefore, we cannot assess the full range of costs associated with the various options, and the overall cost-effectiveness of bonuses remains unclear.

Comparing Bonuses and Educational Benefits

The above comparisons do not consider educational benefits. The bonus test itself does not provide evidence about the effects of such benefits, since they were held constant nationwide throughout the period. In principle, of course, the bonus experiment results could be compared with those of the earlier educational benefits test, which found a 9 percent market expansion effect for the Army College Fund (Fernandez, 1982). Nevertheless, we caution against making a direct comparison between the two test results, because the two programs may have very different costs.

The possible differences between the two programs can be illustrated by their nominal values. During the bonus test period, all people in skills eligible for the new bonuses were also eligible for the special enhanced benefits of the Army College Fund. At that time, an Army member who contributed \$2700 to the fund could eventually accumulate a benefit value of \$20,100, to be used for education after leaving the service. However, that nominal value is related only indirectly to the government's cost. Determining the true cost is very difficult because we cannot reliably project how many recruits will eventually use the benefits, or when they will do so. Moreover, educational benefits, unlike bonuses, may provide an incentive for people to leave the service, thus exerting a negative effect on retention. The Army College Fund has not been in place long enough for us to observe these possible effects or their impact on costs. This situation should soon be improved as more information becomes available from cohorts that entered service during the earlier test. In the meantime, however, we cannot compare the effects found in the bonus and educational benefits tests without making cost assumptions that are difficult to justify.¹³

¹²Disregarding these effects could distort the total cost estimates. For example, it is plausible that increasing the advertising budget by, say, 20 percent, could bring in more recruits, but the new recruits, being less strongly committed to military service than those who currently enlist, would tend to sign contracts for shorter terms. They might also tend to avoid the combat skills. Because of these possibilities, a complete analysis should include assessment of the range of effects that bonuses achieve, not just an assessment of effects on total enlistments.

¹³See App. B for a discussion of the uncertainties in costing both types of programs.

BONUS EFFECTS ON SKILL AND TERM OF SERVICE CHOICES

Up to now we have considered empirical results for the first stage of the enlistment process, examining what is often called the "market expansion" effect. We now turn to the second and third stages of the enlistment decision process, as depicted in Fig. 2: selecting a skill and choosing a term of service.

Analysis Method

To examine skill choices, we add to the previous system one equation that represents high-quality enlistments in eligible skills as a function of the total number of high-quality enlistments, the test cell indicators, and dummy variables for monthly variations:

$$\log(H_E) = \omega_0 + \omega_1 \log(H) + \omega_2 B + \omega_3 M \quad (6)$$

where H_E is the number of high-quality enlistments in test-eligible skills,

H is the number of high-quality enlistments in the Army,

B is a vector of indicators for the cells (two components, one for the B Cell and one for the C Cell),

M is a vector of indicators for months,

ω_0 and ω_1 are scalar coefficients, and

ω_2 and ω_3 are vectors of coefficients.

To examine term choices, we add equations for four-year and three-year terms of enlistment within eligible skills. Each equation (for the i th year) has the form:¹⁴

$$\log(H_{E,i}) = \psi_0 + \psi_1 \log(H_E) + \psi_2 B + \psi_3 M \quad (7)$$

where $H_{E,i}$ is the number of high-quality enlistments for i years in test-eligible skills ($i = 4, 3$),

H_E is the number of high-quality enlistments in test-eligible skills,

B is a vector of indicators for the bonus cells (two components),

M is a vector of indicators for months,

ψ_0 and ψ_1 are scalar coefficients, and

ψ_2 and ψ_3 are vectors of coefficients.¹⁵

¹⁴Because of the large number of zero monthly enlistment counts for two-year terms in many MEPS areas, we estimated the term of enlistment equations using data aggregated to quarters.

¹⁵Certain quantiles of interest are completely determined by this system and can be obtained by subtraction. In particular, the number of high-quality enlistments in noneli-

We further restricted the coefficients on H and H_E (ω_1 and ψ_1) to be unity. This makes, for example, Eq. (6) equivalent to a model representing the *proportion* of high-quality enlistees who enter test-eligible skills.¹⁶ Thus, a given test cell's coefficient in that equation represents the effect of the bonus program on the proportion of enlistments into test-eligible skills, holding constant the number of high-quality enlistees who entered the Army. A similar interpretation applies to the test cell coefficients in the term of service equations, except that the latter equations hold constant the number of high-quality recruits entering eligible skills.¹⁷

Coefficients and Relative Increases in Enlistments

Table 11 displays the test cell coefficients obtained by estimating the preceding models. The first panel shows the results from Eq. (6), estimating high-quality enlistments in test-eligible skills while controlling for the total number of high-quality recruits entering the Army. The second and third panels show results from Eq. (7), estimating high-quality enlistments for four-year and three-year terms within the eligible skills. These coefficients represent strikingly large effects. The estimated B and C Cell effects on test-eligible skills, for example, are six to seven times as large as the market expansion coefficients we found earlier. Moreover, in every case but one (excluding the C Cell, four-year term coefficient of .0042), the coefficients are many times their standard errors, meaning that the estimates are relatively precise and are statistically significant far beyond the conventional levels.

Let us consider the skill channeling effects first. When converted into relative percentage increases, the results imply that the bonus test increased enlistments by about 31 percent in the B Cell and 41 percent in the C Cell, after controlling for changes in the number of total Army high-quality enlistments. These large increases were accompanied by substantial reductions in high-quality enlistments in the *non*eligible

gible skills can be represented as $H_N = H - H_E$; and the number of high-quality enlistments for two years in eligible skills can be represented as $H_{E,2} = H_E - H_{E,4} - H_{E,3}$.

¹⁶This restriction also simplifies the calculation of total effects that combine the effects of market expansion, skill channeling, and term of service choices (to be discussed below). The restriction made little difference in the estimates because the coefficients generally took on values close to unity when estimated without restriction.

¹⁷Note that the above equations define skill channeling in a very specific way: It is the change in the probability that, on average, any individual will choose a test-eligible skill, conditional upon his joining the Army. We do not attempt to isolate the extent of skill channeling among recruits who would have joined the Army in the absence of the test program. This is because we are reluctant to make assumptions about the skill choices of new recruits who were attracted to the Army by the bonus program (see the discussion in App. C).

Table 11

COEFFICIENTS: MODELS OF CONTRACTS BY SKILL GROUP
AND TERM OF SERVICE

Equation	Bonus Program	Coefficient	Standard Error	t
Test-eligible skills	B Cell	.2755	.0306	8.99
Test-eligible skills	C Cell	.3472	.0306	11.34
Four-year term in test-eligible skills	B Cell	.1420	.0212	6.71
Four-year term in test-eligible skills	C Cell	.0042	.0212	0.20
Three-year term in test-eligible skills	B Cell	-.3359	.1028	-3.27
Three-year term in test-eligible skills	C Cell	.6282	.1028	6.11

skills; on the average over the two-year test period, the model indicates that noneligible skill enlistments declined by 9.0 percent in the B Cell and by 12.3 percent in the C Cell.¹⁸ Although the market expansion effect contributed to the increase in eligible skills, clearly cross-skill movements were a larger factor. Thus, many people who would have joined the Army in noneligible skills without the test programs chose to move into the test-eligible skills because of the enhanced bonuses offered.

The second and third panels of Table 11 indicate equally impressive changes in term of service choices. As expected, the B Cell program increased four-year enlistments in eligible skills (coefficient = .1420), and reduced three-year enlistments (coefficient = -.3359). Also as expected, the C Cell program, which offered a new bonus for a three-year enlistment, led to a large upturn in three-year enlistments (coefficient = .6282). Although some feared that the program could "cannibalize" four-year contracts by converting them into three-year contracts, the analysis indicates that was not a problem; the coefficient for

¹⁸During the relevant period, about 28 percent of high-quality enlistments were in test-eligible specialties. Thus, a large percentage increase in eligible skills can be generated by a much smaller reduction in noneligible skills.

the C Cell effect on four-year enlistments is virtually zero.¹⁹ This suggests that after controlling for market expansion and skill channeling effects, the C Cell program produced no net change in the proportion of high-quality recruits who signed up for four years in eligible specialties. Instead, the program's main effect on term of service choices was to persuade recruits who otherwise would have signed up for two years to sign for three years.

The changes discussed above are converted into relative percentage increases in the top panel of Table 12. Thus, the C Cell is estimated to increase high-quality three-year enlistments by 87.4 percent over the level in the A Cell—almost doubling the A Cell level. Note that these are appropriately termed “net effects” because they control for other bonus effects that are estimated by the multi-equation model. That is,

Table 12
NET AND COMPOSITE EFFECTS OF BONUS PROGRAMS
(Percentage increases)

Type of Effect	Dependent Variable	Estimated Effect ^a	
		B Cell Program	C Cell Program
<i>Net</i>			
Market expansion	HQ contracts (all skills)	4.1	5.0
Skill channeling	HQ contracts in test-eligible skills	31.7	41.5
Term of service	HQ contracts for four years in test-eligible skills	15.3	0.4
Term of service	HQ contracts for three years in test-eligible skills	-28.5	87.4
<i>Composite</i>			
Skill channeling	HQ contracts in test-eligible skills	37.1	48.6
Term of service	HQ contracts for four years in test-eligible skills	58.0	49.2
Term of service	HQ contracts for three years in test-eligible skills	-2.0	178.5

^aEstimated effect given as percentage increase relative to control.

¹⁹ Apparently, any movement from four-year to three-year terms was offset by other movements (e.g., from two-year to four-year terms).

the percentage increases estimated for skill channeling are "net" of the market expansion effect, and the increases estimated for term of service choices are "net" of the market expansion and skill channeling effects.

TOTAL EFFECTS

The net effects are useful for analytic purposes, since they partition the various sources of changes in any category of enlistments. For some policy planning purposes, however, it is useful to combine them into total effects. For instance, suppose we were contemplating a shift from the control program to the B Cell program, and we were interested in predicting the resulting number of four-year contracts in test-eligible skills. That number would differ from the A Cell quantity as a consequence of three net effects:

1. Market expansion: A 4.1 percent increase in Army high-quality contracts.
2. Skill channeling: A 31.7 increase in test-eligible skill contract.
3. Term of service: A 15.3 percent increase in four-year terms.

These three effects may be combined, given the structure of the model, as follows:²⁰

$$\text{Total effect} = (1.041)(1.317)(1.153) = 1.580$$

where each multiplicative factor corresponds to a percentage increase for a net effect.

Similar calculations lead to the results in the lower panel of Table 12. Note the dramatic changes in each category that bonuses are intended to help fill. In every such case, the tested bonus programs produced increases of at least 37 percent, and in the case of the C Cell effect on three-year terms, the results were startling: an increase of 178 percent, that is, 2.78 times the initial level of enlistments.

²⁰Because of the restrictions imposed on the coefficients for H_1 and H_2 in Eqs. (6) and (7), respectively, the total effect of a test cell, considering net effects at each of the three stages, can be estimated by simply multiplying relative increase factors corresponding to each stage. This can readily be seen by substituting Eq. (6) into Eq. (7) and taking the partial derivative of $H_{2,1}$ with respect to a test cell indicator.

MAN-YEAR PROJECTIONS

The model estimates can be combined to project the actual numbers of enlistments that would be observed, by skill and term of service, if certain bonus policies were altered. Table 13 shows results of one such projection, which contains an important observation about the effects of bonus programs on total man-years available to the Army. It asks the question: What would happen to the distribution of personnel and to the total number of man-years obligated by recruits if we shifted nationwide from the control program to one of the test programs?

The base case data were projected from results in the A Cell during the most recent period for which we have relevant data, the final year of the bonus test (July 1983 through June 1984).²¹ Projections for the

Table 13

PROJECTED MAN-YEAR CHANGES FOR BONUS PROGRAMS

Item	Projection Assuming Nationwide Implementation of Program		
	A Cell Program	B Cell Program	C Cell Program
<i>High-quality contracts in test-eligible skills</i>			
Four years (percent of total)	71.4	82.3	71.7
Three years (percent of total)	10.4	7.4	19.6
Two years (percent of total)	18.2	10.3	8.8
Total contracts (number)	13,801	18,919	20,510
Obligated man-years	48,748	70,355	74,432
<i>High-quality contracts in noneligible skills</i>			
Four years (percent of total)	40.2	37.2	42.8
Three years (percent of total)	42.1	45.2	43.4
Two years (percent of total)	17.7	17.6	14.0
Total contracts	42,438	39,609	38,552
Obligated man-years	138,883	128,607	128,693
Total high-quality contracts, all skills	56,239	58,528	59,082
Total obligated man-years	186,609	196,992	201,125
Percentage change in man-years, relative to A Cell program	—	6.1	8.4

²¹The figures in the A Cell column were estimated by dividing the observed enlistment counts for the A Cell during that period by .7 to adjust for the size of the A Cell (70 percent of the U.S. population).

B and C Cell programs were made using the total effect estimates and equations derived above, applied to the figures in the A Cell column.

A preliminary observation may be made from inspecting the percentage distributions by term of service. Under the B Cell program, the projection indicates a proportionate increase in four-year contracts and corresponding reductions in three-year and two-year contracts; under the C Cell, it shows the large growth in three-year contracts at the expense of two-year ones. This implies that the bonus programs produced large increments in the number of man-years obligated to the test-eligible skills—from 48,746 under the A Cell to 74,432 under the C Cell program. However, there is the possibility that these increases came about merely at the expense of the other skills. For example, some of the C Cell recruits signing up for three years in eligible skills might have signed for four years in other skills if the control plan had been in force.

To address that issue, we need to consider the noneligible specialties as well. Table 13 shows that under this projection the term of service distribution for noneligible skills is only slightly altered by shifting to the test programs. Under the C Cell plan, for example, the proportion of noneligible skill recruits choosing a four-year term remains about the same as it was before. The result, when all factors are considered together, is a total Army increase in obligated man-years. This projection estimates that under the B Cell program, the Army would obtain 6.1 percent more man-years than under the control plan. Under the C Cell program the increase would be 8.4 percent.

These percentage increases are larger than the market expansion effects for recruits because the test bonus programs did more than attract new people to the Army; they also persuaded some recruits who would have enlisted anyway to enlist for longer terms. The combined effect raised the number of obligated man-years by more than the market expansion effect alone. In addition, the Army obtained the benefit of shifting people from noneligible skills into test-eligible skills, which have chronically been difficult to fill.

VI. CONCLUSIONS

The continued viability of the armed forces depends on sufficient numbers of high-quality recruits flowing smoothly into critical occupational specialties. Managing that flow requires an appropriate volume, allocation, and timing of enlistments. The experimental outcomes described in this report demonstrate that enlistment bonuses can be an effective policy option for efficiently managing the recruiting process. In both the B Cell and C Cell programs, cash bonuses were extremely effective at channeling high-quality individuals into occupations, primarily the combat arms, that have traditionally been the most difficult to fill. We have seen that high-quality contracts in the test-eligible skills rose sharply, by 31.7 and 41.5 percent in the B and C Cells respectively, even after controlling for other effects.

Furthermore, the results demonstrate that bonus policy can significantly affect the number of individuals willing to make longer-term commitments to military service. The B Cell program increased the proportion of enlistees committing to four-year terms by 15 percent, after controlling for the program's other effects. And the C Cell plan increased three-year enlistments by an impressive 87 percent, without reducing the number of recruits who committed for four years. A major factor contributing to these results was the bonuses' ability to move people from two-year commitments to three- and four-year obligations.

In addition, a bonus program targeted at hard-to-fill occupations can have a modest "market expansion" effect, increasing the total number of high-quality recruits. Market expansion is a complex phenomenon, driven by numerous exogenous supply factors such as economic conditions, recruiter strength, and advertising, as well as by the incentives and missions given to recruiters. Our analysis, controlling for all of these factors, indicates that if recruiters are managed with appropriate incentives, the B and C Cell programs can increase the number of high-quality Army enlistees by 4 and 5 percent, respectively.

The market expansion results are magnified when viewed in conjunction with the bonuses' simultaneous effects on term of service choices. Because the expanded bonuses *both* brought more people in and lengthened their average term of commitment, they increased total obligated man-years by 6 percent in the B Cell and 8 percent in the C Cell. Considering that only 21 percent of all high-quality enlistees

received these bonuses, these increases are impressive and consistent with the range of pay elasticities reported in previous research.

On the other hand, when converted to a per unit cost basis, crude calculations suggest that the marginal cost of attracting an additional high-quality recruit via bonuses, about \$16,000, may be high relative to alternative expenditures, such as local and national advertising or recruiting staff. However, such comparisons are extremely complex, and to make them properly would require information that is not now available. For example, appropriate cost comparisons for bonuses should consider the subsequent performance, attrition, and reenlistment behavior of recruits attracted by bonuses, as well as the added costs for other benefits that must be paid to enlistees channeled into bonus-eligible occupations; comparisons involving recruiters should consider the full life-cycle expenses of recruiters and opportunity costs of personnel removed from other duties to conduct recruiting.¹ These important but difficult cost issues deserve priority in future enlistment supply research.

Of all the alternative policy options available, bonuses are the most flexible. Without altering the fundamental structure or level of military compensation, bonuses can be swiftly changed in response to critical shortfalls in particular personnel categories. This high degree of flexibility, combined with the dramatic impact of bonuses on occupation and term of service choices, make enlistment bonuses a useful option for short-term management of enlistment flows and for targeting incentives toward particular subgroups.

¹See App. B for a brief discussion of the challenges in costing such effects.

Appendix A

SUPPLEMENTARY TABLES

Table A.1 defines the variables used in balancing the experiment. Table A.2 lists the Military Occupational Specialties eligible for the experimental benefits. Table A.3 shows the means and standard deviations for variables used in the analysis.

Table A.1

BONUS TEST BALANCING VARIABLES

Variable Name	Definition
1. Enlistment rate	Number of Army high-quality male enlistments in October-February FY 1982, as a percentage of high-quality males 17-21 who are "qualified, military available" (QMA)
2. Unemployment rate	Unemployment rate of workers 16 and older, January-December 1981, in percentage
3. Wage rate	Ratio of civilian to military wage rate (hourly wage rate for manufacturing production workers divided by hourly rate of basic military pay, January-December 1981)
4. High-quality concentration	Number of high-quality QMA males 17-21, as a percentage of total male population 17-21
5. Percent nonwhite	Number of nonwhite males 17-21, as a percentage of total male population 17-21
6. Recruiter density	Number of Army production recruiters, January-June 1981, per thousand QMA males 17-21
7. Army mission	Number of Army high-quality nonprior service males to be recruited in October-March FY 1982, as a percentage of number of high-quality QMA males 17-21 in the population
8. Eastern region	Indicator variable for Census Eastern region
9. Southern region	Indicator variable for Census Southern region
10. Western region	Indicator variable for Census Western region

Table A.2

TEST-ELIGIBLE OCCUPATIONAL SPECIALTIES

<u>Specialty Code</u>	<u>Occupation</u>
08H	Signal/Intelligence
11X	Infantry
13B, 13E, 13F	Field Artillery
15E	Pershing Missile Crew
19A	Armor

Table A.3

MEANS AND STANDARD DEVIATIONS OF ANALYSIS VARIABLES

<u>Variable Name</u>	<u>Mean^a</u>	<u>Standard Deviation</u>
Number of high-quality contracts	71.0	49.3
Number of high-quality contracts in eligible skills	20.2	13.9
Number of low-quality contracts	78.9	55.5
Unemployment rate (percent)	5.55	2.30
Civilian wage rate (dollars per hour)	5.62	1.19
Number of production recruiters	73.8	48.3
National advertising expenditures (\$000)	24.0	23.1
Local advertising expenditures (\$000)	5.3	5.1
High-quality quota	64.0	44.5
Low-quality quota	72.5	45.6

^aBased on 2376 observations (66 MRPS areas, each measured during 36 months).

Appendix B

A NOTE ON COSTS

The enlistment bonus experiment was set up to estimate the effects of various bonus programs, not to provide a full framework for comparing bonuses with other policy alternatives. Nevertheless, any discussion of program effects inevitably leads to calculations of the associated costs, and to assessments of alternative policies that might accomplish the same end. These issues arise in a number of places in the text.

We are not in a position to assess the full cost of the bonuses tested in the experiment, or to make a complete comparison of the cost-effectiveness of bonuses with other recruiting resource expenditures. We can, however, assess some of the costs and identify some important other cost elements that should be considered in future comparative analyses. A basic principle of such an analysis should be to include all significant costs of the program, and all effects that are likely to impose significant costs in the future. For example, if a program solves immediate recruiting shortfalls while committing the Department of Defense to large future training costs, it may not be a bargain.

That principle makes it difficult to prepare total program cost estimates with the data available. For example, although we discuss the marginal cost of obtaining a recruit in the market expansion part of Sec. V, we point out there that the bonus test programs also accomplished other ends: they moved people from noneligible to test-eligible (shortage) skills, and they increased recruits' obligated terms of service. Presumably the Department of Defense and the Army place a high value on filling shortage skills, but we have no way of quantifying that value for a cost analysis. The term of service issue is more tractable, but even there complications arise. For instance, from Table 13 one can easily calculate that the cash bonuses paid to recruits in eligible skills total about \$49.3 million under the A Cell projection, but they total to \$124.6 million under the B Cell and \$133.6 million under the C Cell plan.¹ If these were the only cost changes, they would imply that the additional cost of an obligated man-year obtained through the

¹Under the A program, \$5000 is paid to each high-quality recruit enlisting for four years in an eligible skill. Under the B program, the amount rises to \$8000. Under the C program, each four-year contract signer earns an \$8000 payment and each three-year signer a \$4000 payment.

bonus change is between \$5000 and \$7000. However, such a simple cost comparison is not complete for several reasons.

First, the changes in man-year obligations are not all likely to be of equal value to the Army. The third year of service, for instance, may be less valuable than the fourth year because of increasing productivity over time. This change is also likely to vary substantially across individual specialties; the value of an additional year of experience in the combat-arms skills may not rise as steeply as an additional year in electronics skills, particularly if it takes only four months to train the former but more than one year to train the latter. Therefore, the value of the additional man-years obtained through skill channeling (or term of service shifts) may depend heavily on which occupational specialty is losing and which is gaining when bonus policy is changed.

Second, new recruits and new man-years gained by the bonus payment should be adjusted for possible attrition. Attrition could be higher for people attracted by bonus payments than for others, if the newly attracted recruits are less committed to the Army or more "marginal" because of their civilian opportunities, attitudes toward military service, etc. Unfortunately, this possible elevated attrition effect cannot be determined from our data.

Third, and perhaps most important, movements of recruits across occupational specialties may represent additional costs or savings for the government, because they change the amount paid for other incentives. Some of the recruits moving into eligible skills, for example, may be leaving skills that pay a \$3000 bonus; hence the government saves that amount. Such movements may also have unanticipated future effects, e.g., increasing the stock of more junior personnel in a skill and therefore reducing its reenlistment bonus requirements. Or, the bonus may move some people from skills that do not offer the Army College Fund into skills that are eligible for both the bonus and the Fund. Tracing these movements across individual skills is beyond the scope of this study. Yet the costs could be high, particularly if the changes are linked to educational benefits (Congressional Budget Office, 1982).

As we have noted in the text, educational benefits are difficult to cost accurately because the expenditures are far in the future, the benefits will be used by an unknown fraction of recruits, and the appropriate discount rate is uncertain. Further, an educational benefit, which pays for a person's civilian postservice education, may represent an incentive for him to leave the service, thus depressing retention rates and causing increased recruiting and training costs to counter the losses. At this time, the ultimate costs of the Army College Fund are not known because few members of the cohorts receiving it have reached the point of drawing on their benefits. Because of these

uncertainties, we have not attempted to cost the bonus changes in full. A complete and reliable estimate of the costs of changing the bonus program would require more detailed analysis and more information than is now available.

Appendix C

DEFINITIONS OF SKILL CHANNELING AND MARKET EXPANSION

It is important to be explicit about the meaning of "skill channeling" and "market expansion" in our analysis. In effect, our definitions treat the enlistment process as a series of steps: first the individual decides whether to join the service; then he decides on a skill; and then he chooses a term of service. In our system, "market expansion" reflects the total increase in the number of high-quality people entering the Army, regardless of which skill they select. "Skill channeling" reflects the change in the probability that any individual will choose a test-eligible skill, conditional upon his joining the Army.

Alternative definitions could be applied if one attempted to focus more precisely on marginal individuals (those who are newly attracted to the Army by the test programs), as compared with "original" recruits (those who would have enlisted under the control program). This can only be done, however, by making assumptions about the skill choices of new vs. original recruits. Suppose that we were willing to assume that all recruits who were attracted by the bonus test program chose eligible skills. Under that assumption, one could estimate a market expansion effect for the eligible skills, and a skill channeling effect within the original group of enlistees. Table C.1 exhibits some illustrative hypothetical data for a typical MEPS, showing a distribution that is broadly similar to the bonus test's actual outcome.

Let us illustrate the alternative concepts heuristically using univariate statistics (without regression modeling). Applying the definitions of market expansion and skill channeling that are used in Sec. V to the hypothetical data in Table C.1, we can conclude that the market expansion effect for this MEPS was 5 percent (420/400). The skill channeling effect was 52 percent (160/420 divided by 100/400). That is, the total number of high-quality enlistees increased by 5 percent and, given that an individual had enlisted, his probability of entering an eligible skill increased by 52 percent.

Now, however, consider an alternative definition, under which we assume that all 20 new people attracted to the Army by the bonus program entered eligible skills. With this assumption we can calculate that the market expansion effect of the bonus program increased enlistments in the eligible skills by 20 percent (20 new entrants,

Table C.1
HYPOTHETICAL DATA ILLUSTRATING MARKET EXPANSION
AND SKILL CHANNELING EFFECTS

	Number of High-Quality Enlistments	
	Control Program	Test Program
Eligible skills	100	160
Noneligible skills	300	260
Total	400	420
Effect definitions in Sec. V		
Market expansion	—	.05
Skill channeling	—	.52
Alternative definitions		
Market expansion for eligible skills	—	.20
Skill channeling among original enlistees	—	.40

divided by 100 original entrants). The 20 percent figure could be treated as a "market expansion" effect for the eligible skills.

Further, because all 20 new enlistees entered eligible skills, one can deduce the changes in skill choices among people who would have enlisted under the control program. Under the test program, 160 people chose eligible skills; but we have just stipulated that 20 of those were new entrants to the Army. The remaining 140 eligible-skill enlistees must have come from the group of original recruits. With this information, one could define "skill channeling among original enlistees" as 40 percent (140/100). In effect, such a definitional scheme assumes that all new recruits are channeled into eligible skills, and reserves the term "skill channeling" for the effect among original recruits. Given the empirical results found in the bonus experiment, the Sec. V market expansion effect would necessarily be smaller than the "market expansion for eligible skills" defined here. In contrast, the Sec. V skill channeling effect would be larger than the "skill channeling among original enlistees" defined here.

Selection of the appropriate definition depends largely on the plausibility of the underlying assumptions. We did not adopt the alternative

definition because it makes an assumption that we believe is too strong. It was observed in the educational benefits experiment that many individuals were attracted to military service by the availability of a large educational benefit, but that ultimately they entered skills that did not offer the benefit (Fernandez, 1982). With that evidence, we did not think it reasonable to make such a strong presumption in the bonus analysis.

BIBLIOGRAPHY

- Armor, David J., Richard L. Fernandez, Kathy Bers, and Donna Schwarzbach, *Recruit Aptitudes and Army Job Performance*, The Rand Corporation, R-2874-MRAL, 1982.
- Bray, Robert M., et al., *Youth Attitude Tracking Study II: Fall 1984*, Defense Manpower Data Center, Arlington, Virginia, 1985.
- Buddin, Richard, *Determinants of First-Term Attrition*, The Rand Corporation, R-3069-MIL, July 1984.
- Congressional Budget Office, *Improving Military Educational Benefits: Effects on Costs, Recruiting, and Retention*, Washington, D.C., 1982.
- Dertouzos, James N., "Recruiter Incentives and the Marginal Cost of Accessions," in Barry E. Goodstadt, G. Thomas Sicilia, and H. Wallace Sinalco (eds.), *Proceedings of the Joint Service Workshop on Recruiter Productivity* (held at the U.S. Naval Postgraduate School, Monterey, California, February 28-March 1, 1983), Arthur D. Little, Inc., for the Office of the Assistant Secretary of Defense (MRA&L), Washington, D.C., May 1983.
- Dertouzos, James N., *Recruiter Incentives and Enlistment Supply*, The Rand Corporation, R-3065-MIL, May 1985.
- Fernandez, Richard L., *Enlistment Effects and Policy Implications of the Educational Assistance Test Program*, The Rand Corporation, R-2935-MRAL, September 1982.
- Haggstrom, Gus W., Thomas J. Blaschke, Winston K. Chow, and William Lisowski, *The Multiple Option Recruiting Experiment*, The Rand Corporation, R-2671-MRAL, November 1981.
- Kennedy, P. E., "Estimation with Correctly Interpreted Dummy Variables in Semilogarithmic Equations," *American Economic Review*, September 1981.
- Korb, Lawrence J. (Assistant Secretary of Defense for Manpower, Installations, and Logistics), Testimony before the House Subcommittee on Manpower and Personnel, Committee on Armed Services, Washington, D.C., May 1982.
- Leamer, Edward E., *Specification Searches*, John Wiley and Sons, New York, 1978.
- Office of the Assistant Secretary of Defense for Manpower, Installations, and Logistics, *Quality of Military Enlisted Personnel*, Report to the House and Senate Committees on Armed Services, Washington, D.C., 1985.

Office of the Assistant Secretary of Defense for Manpower, Installations, and Logistics, *Profile of American Youth*, Washington, D.C., 1982.

Plosser, Charles I., William G. Schwert, and Halbert White, "Differencing as a Test of Specification," *International Economic Review*, Vol. 23, No. 3, October 1982, pp. 535-552.

Press, S. James, "The MISER Criterion for Imbalance in the Analysis of Covariance," The Rand Corporation, P-7086, April 1985.

Tan, Hong W., and Michael P. Ward, *Forecasting the Wages of Young Men*, The Rand Corporation, R-3115-ARMY, May 1985.

U.S. House of Representatives, Committee on Armed Services, *Uniformed Services Pay Act of 1981*, Washington, D.C., October 1981.

U.S. House of Representatives, Conference Report, House Report No. 97-265 (Report Accompanying the Uniformed Services Pay Act of 1981), *Congressional Record*, Washington, D.C., October 6, 1981, pp. H7121-H7130.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER R-3353-FMP	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) The Enlistment Bonus Experiment	5. TYPE OF REPORT & PERIOD COVERED Interim	
6. AUTHOR(s) J. M. Polich; J. N. Dertouzos, S. J. Press		7. PERFORMING ORG. REPORT NUMBER
8. PERFORMING ORGANIZATION NAME AND ADDRESS The Rand Corporation 1700 Main Street Santa Monica, CA 90406		9. CONTRACT OR GRANT NUMBER(s) MDA903-85-C-0030
10. CONTROLLING OFFICE NAME AND ADDRESS Office of the Assistant Secretary of Defense, Force Management and Personnel Washington, DC 20301		11. REPORT DATE March 1986
12. DISTRIBUTION STATEMENT (of this Report)		13. NUMBER OF PAGES 30
14. SECURITY CLASS. (of this report) Unclassified		15. SECURITY CLASS. (of this report) Unclassified
16. DISTRIBUTION STATEMENT (of this Report) Approved for Public Release; Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) No Restrictions		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Enlisted Personnel, Recruiting, Reenlistment, Army personnel, Bonuses, Incentive Contracts.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) see reverse side		

DD FORM 1473

EDITION OF 1 NOV 64 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

→ One of the principal challenges for defense managers in recent years has been to attract military recruits within a reasonable level of recruiting expenditure. This report describes the results of a nationwide experiment designed to provide new data on a key enlistment incentive: the cash enlistment bonus, which is paid to qualified recruits entering critical occupational specialties. The report documents the experiment, explains the analysis of its results, and assesses the effects of enlistment bonuses on the Army recruiting process. It addresses three principal effects of the bonus program: (1) attracting "high-quality" recruits into the Army; (2) encouraging enlistments in hard-to-fill critical specialties; and (3) influencing recruits to sign contracts for longer terms of service. The experimental results show that bonuses have substantial effects on recruiting and are a very flexible policy tool, making them a useful option for management of enlistment flows and for overcoming personnel shortages in critical skills. *Keywords:*

FLD 19